End User Documentation **CUSTOMER**

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SAP InfiniteInsight® 6.5 SP5

Time Series User Guide

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1 Welcome to this Guide

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1.1 About this Document

1.1.1 Who Should Read this Document

This document is addressed to people who want to evaluate or use SAP InfiniteInsight® and in particular the *InfiniteInsight® Modeler – Time Series* feature.

1.1.2 Prerequisites for Use of this Document

Before reading this guide, you should read chapters 2 and 3 of the **InfiniteInsight® - User Guide** that present respectively:

- An introduction to SAP InfiniteInsight®
- The essential concepts related to the use of SAP InfiniteInsight® features

No prior knowledge of SQL is required to use Data Manipulation - only knowledge about how to work with tables and columns accessed through ODBC sources. Furthermore, users must have “read” access on these ODBC sources.

To use the InfiniteInsight® modeling assistant, users need write access on the tables `KxAdmin` and `ConnectorsTable`, which are used to store representations of data manipulations.

For more technical details regarding SAP InfiniteInsight®, please contact us. We will be happy to provide you with more technical information and documentation.

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1.1.3 What this Document Covers

This document introduces you to the main functionalities of the *InfiniteInsight® Modeler – Time Series* feature. Using the application scenario you can create your first models with confidence.

InfiniteInsight® Modeler – Time Series (formerly known as KTS) lets you build predictive models from data representing time series. Thanks to *InfiniteInsight® Modeler – Time Series* models, you can:

- Identify and understand the phenomenon represented by your time series.
- Forecast the evolution of time series in the short and medium term, that is, predict their future values.

To know more about the basic concepts underpinning SAP InfiniteInsight®, read the **Introductory Guide to SAP InfiniteInsight®**.

1.1.4 How to Use this Document

Organization of this Document

This document is subdivided into three chapters.

This chapter, **Welcome to this Guide**, serves as an introduction to the rest of the guide. This is where you will find information pertaining to the reading of this guide, and information that will allow you to contact us.

The Chapter 2, **General Introduction to Scenario**, provides a summary to the *InfiniteInsight® Modeler – Time Series* application scenario. It also introduces the user interface and the data files used in this scenario.

The Chapter 3, **Using the InfiniteInsight® Modeler – Time Series feature**, presents the *InfiniteInsight® Modeler – Time Series* feature. This chapter is organized in two parts:

- The first part presents the standard use of the *InfiniteInsight® Modeler – Time Series* feature,
- The second part presents the use of the *InfiniteInsight® Modeler – Time Series* with extra predictable inputs.

A summary and detailed table of contents located at the beginning of the guide and cross-references throughout the document allow you to find the information that you need, quickly and easily.

If you want more information on SAP InfiniteInsight® and on the essential concepts of modeling data, read the **InfiniteInsight® - User Guide** provided with SAP InfiniteInsight® software.

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1.2 Before Beginning

1.2.1 Files and Documentation Provided with this Guide

Sample Data Files

Both the evaluation version and the registered version of SAP InfiniteInsight® are supplied with sample data files. These files allow you to take your first steps using various features of SAP InfiniteInsight®, and evaluate them.

During installation of SAP InfiniteInsight®, the following sample files for *InfiniteInsight® Modeler – Time Series* are saved under the folder `<installation directory>/Samples/KTS/`:

- `R_ozone-la.txt`,
- `CashFlows.txt`,
- `KxDesc_CashFlows.txt`.

To obtain a detailed description of these files, see Introduction to Sample Files (on page 8).

Documentation

Full Documentation

Complete documentation is included with SAP InfiniteInsight®. This documentation covers:

- The operational use of SAP InfiniteInsight® features,
- The architecture and integration of the SAP InfiniteInsight® API,
- The SAP InfiniteInsight® Java graphical user interface.

Contextual Help

Each screen in the InfiniteInsight® modeling assistant is accompanied by contextual help that describes the options presented to you, and the concepts required for their application.

☑ To Display the Contextual Help

1. Click the *Help* button located on the screen lower left corner.
2. Click the *Previous* button to go back to the original screen.

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2 General Introduction to Scenarios

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2.1 Scenario 1

This scenario demonstrates how to use the *InfiniteInsight® Modeler – Time Series* feature for creating a standard model.

The data used in this scenario are monthly averages of hourly ozone (O3) readings in downtown Los Angeles from 1955 to 1972.

Ozone is a gas providing a protective shield against the ultraviolet radiation. When found in the lower atmosphere, it is a major component of smog. Thus ozone rate is a common measure for smog intensity.

Los Angeles municipality took three measures in order to reduce this level and so decrease the smog downtown:

- in 1960, the Golden State Freeway, which sails round downtown, opened,
- in the same year, the rule 63 came into effect, lowering the amount of allowable reactive hydrocarbons in gasoline,
- in 1966, emission regulations for new car engines were introduced.

The purpose of this scenario is to confirm the decreasing trend of the ozone rate by predicting the next 18 months and describing the different signal elements based on the ozone rate.

2.2 Scenario 2

This scenario demonstrates how to use the *InfiniteInsight® Modeler – Time Series* feature to create a model with extra predictable inputs.

In this scenario, you are an executive of a financial entity that manages cash-flows. Your role is to make sure that credits are available with the correct amount at the correct date to provide the best management possible of your financial flows.

Time Series provides you with two methods for reaching your objective:

- creating a standard model,
- creating a model with extra predictable variables.

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2.3 Introduction to Sample Files

SAP InfiniteInsight® is provided with sample data files allowing you to evaluate the *InfiniteInsight® Modeler – Time Series* feature and take your first steps in using it.

The file *R_ozone-la.txt* is the sample data file that you will use to follow Scenario 1 of the **Time Series** feature. It is an excerpt from the book Time Series Analysis: Forecasting and Control (G.E.P. Box and G.M. Jenkins), Third Edition, Prentice-Hall, 1994 .

This file presents monthly averages of hourly ozone (O3) readings in downtown Los Angeles from 1955 to 1972. Each observation is characterized by 2 data items. These data, or variables, are described in the following table.

Variable	Description	Example of Values
Time	Month and year of the readings	A date in the format yyyy-mm-dd, such as *1955-01-28*
R_ozone-la	Average of the hourly readings for the month	A numerical value with two decimals

The file *CashFlows.txt* is the sample data file used to follow Scenario 2 of the **Time Series** feature and use the extras predictable inputs.

This file presents daily measures of cash flows from January 2, 1998 to September, 30 1998. Each observation is characterized by 25 data items. The data or variables are described in the following table.

Variable	Description	Example of values
Date	Day, month and year of the readings	A date in the format yyyy-mm-dd such as 1998-01-02
Cash	Cash flow	A numerical value with n decimals
BeforeLastMonday, LastMonday, BeforeLastTuesday, LastTuesday, BeforeLastWednesday, LastWednesday, BeforeLastThursday, LastThursday, BeforeLastFriday, LastFriday	Boolean variables that indicates if the information is true or false	1 if the information is true.
Last5WDays, Last4WDays	Boolean variables that indicate if the date is in the 5 or 4 last working days of the month	1 if the information is true.
LastWMonth, BeforeLastWMonth	Boolean variables that indicates if the information is true or false	1 if the information is true.
WorkingDaysIndices, ReverseWorkingDaysIndices	Indices or reverse indices of the working days	An integer value
MondayMonthInd, TuesdayMonthInd, WednesdayMonthInd, ThursdayMonthInd, FridayMonthInd	Indices of the week days in the month	An integer value
Last5WDaysInd, Last4WDaysInd	Indices of the 5 or 4 last working days of the month	An integer value

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- The file *KxDesc_CashFlows.txt* is the description file corresponding to the data file *CashFlows.txt*.

2.3.1 Additional Sample Files

Additional sample files are provided to further test Time Series:

- Lag1AndCycles.txt
- Lag1AndCyclesAndWn.txt
- TrendAndCyclic.txt
- TrendAndCyclicAnd_4Wn.txt
- TrendAndCyclicAndWn.txt

These files are located in the folder *Samples\KTS*.

2.4 File Format Specifications

A training data file for Time Series must contain at least two columns:

- The date column,
- The signal column.

Three formats are supported for the Date column:

- datetime (ISO format: yyyy-mm-dd hh:mm), which has an hour-precision.
- date (ISO format: yyyy-mm-dd), which has a day-precision.
- number (number, for example "seconds")

The signal column (that is, the target variable) must be continuous.

An optional weight column can be used to tweak the modeling procedure. Setting the weight of some rows to 0 allows ignoring these rows during the modeling process. By default, when a weight variable is not provided, all rows have a weight of 1.

2.4.1 For Extra Predictable Variables

Future values of the Extra Predictable Inputs have to be filled in order to use them in a modeling session. These variables have to be filled at least in the same range as the wanted forecasts. The file will have the appearance described by the table below (Time Series allows missing values in the extra-predictable variables).

Line Index	Date	Monday	Tuesday	Wednesday	Thursday	Friday	...	WorkingDayIndices	...	FlowsEmitted
...	...	...	...	...	...	...	...	...	...	...
177	1998-09-22	0	1	0	0	0	...	15	...	-242.1920724
178	1998-09-23	0	0	1	0	0	...	16	...	-395.9563714
179	1998-09-24	0	0	0	1	0	...	17	...	-381.9100825
180	1998-09-25	0	0	0	0	1	...	18	...	-769.5131684
181	1998-09-28	1	0	0	0	0	...	19	...	-1679.648843
182	1998-09-29	0	1	0	0	0	...	20	...	-1124.288375
183	1998-09-30	0	0	1	0	0	...	21	...	-601.915403
184	1998-10-01	0	0	0	1	0	...	1	...	
185	1998-10-02	0	0	0	0	1	...	2	...	
186	1998-10-05	1	0	0	0	0	...	3	...	
...	...	...	...	...	...	...	...	...	...	

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The last known signal value is at the line 183 with the corresponding date 1998-09-30. This line corresponds to the end of the training data set. The figures present after this line are the future values of the extras predictable variables: these figures are considered as predictive information.

Please note that the date variable has a special status. This variable is not considered as an extra predictable input, nevertheless it is possible to fill its future values. If you fill this variable in the predicted range, the *InfiniteInsight® Modeler – Time Series* engine will use the values for forecasting. If you don't, it will generate the future dates. This is true whether extra predictable variables exist or not. This feature can be very useful if you are not satisfied by the dates automatically generated by the *InfiniteInsight® Modeler – Time Series* engine.

The same file format has to be used for the training data set and the application data set.

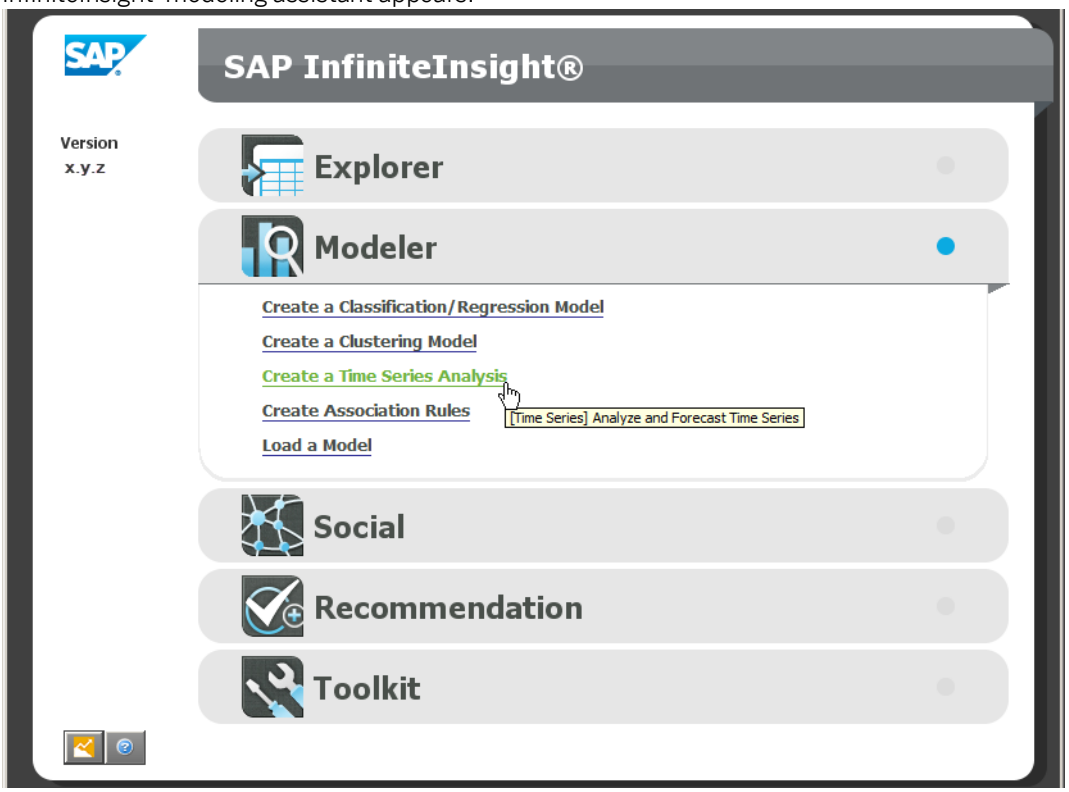
> **Note**
>
> If you want to use your own dates instead of the automatic date generation, please follow the same steps as the addition of extras predictable inputs.

2.5 InfiniteInsight® Modeling Assistant

To accomplish the scenario, you will use the Java-based graphical interface of SAP InfiniteInsight®. InfiniteInsight® modeling assistant allows you to select the SAP InfiniteInsight® features with which you will work, and help you at all stages of the modeling process.

☑ To Start the InfiniteInsight® Modeling Assistant

1 Select *Start* > *Programs* > *SAP Business Intelligence* > *SAP SAP InfiniteInsight®* > *SAP InfiniteInsight®*
InfiniteInsight® modeling assistant appears.



2 Select the *Create a Time Series Analysis* feature.

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3 Scenario 1: Standard Modeling with InfiniteInsight® Modeler – Time Series

Data modeling with *InfiniteInsight® Modeler – Time Series* is subdivided into four broadly defined stages:

1. **Defining** the Modeling Parameters
2. **Generating and Validating** the Model
3. **Analyzing and Understanding** the Analytical Results
4. **Using** a Generated Model

IN THIS CHAPTER

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Step 4 - Using the Model 49

3.1 Options of the InfiniteInsight® modeling assistant

On every screen of the InfiniteInsight® modeling assistant, one or more of the following options may be available in a toolbar located under the screen title.

☑ To Print the Screen

1. Click the (*Print*) button.
   A dialog box appears, asking you to select the printer to use.
2. Select the printer to use and set other print properties if need be.
3. Click *OK*.
   The screen content is printed.

☑ To Save the Screen Content

1. Click the (*Save*) button.
   A dialog box appears, asking you to select the file properties.
2. Type a name for your file.
3. Select the destination folder.
4. Click *OK*.
   If the screen displays:
   - A graph, it is saved as a PNG image
   - A report, it is saved as an HTML file

☑ To Copy the Screen Content

Click the (*Copy*) button.
If the screen displays:

- A report, the application copies its HTML code. You can paste it into a word processing program or into a spreadsheet program (such as Excel) and use it to generate your own graph.
- A graph, the application copies its parameters. You can paste it into a spreadsheet program (such as Excel) and use it to generate your own graph.

☑ To Display the Contextual Help

1 Click the help button at the bottom left of the screen.
The help screen appears.

2 Click the *Previous* button to go back to the modeling screen. Note that when there is no contextual help available for the current screen, the help button is disabled.

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3.2 Step 1 - Defining the Modeling Parameters

IN THIS CHAPTER

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Selecting a Cutting Strategy 14
Describing the Data Selected 15
Selecting Variables 17
Checking Modeling Parameters 20

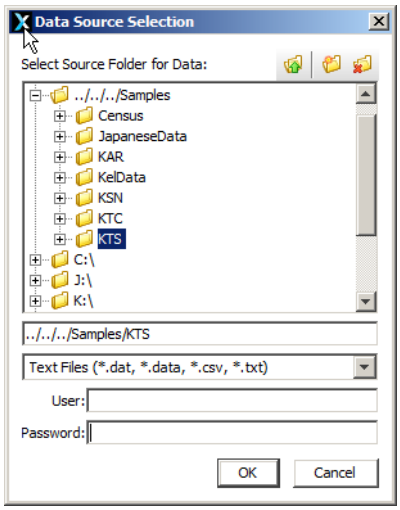
3.2.1 Selecting a Data Source

For this scenario

Use the file `R_ozone-la.txt` as a training data set.

To Select a Data Source

1. On the screen *Select a Data Source*, select the option *Data Type* to select the data source format to be used.
2. Click the *Browse* button.
   The following dialog box appears.



3. Double-click the *Samples* folder, then the *KTS* folder.

> **Note**
>
> Depending on your environment, the `Samples` folder may or may not appear directly at the root of the list of folders. If you selected the default settings during the installation process, you will find the `Samples` folder located in `C:\Program Files\SAP InfiniteInsight\InfiniteInsightVx.y.z\`.

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4 Select the file *R_ozone-la.txt*, then click *OK*.
The name of the file appears in the *Data Set* field.

3.2.2 Selecting a Cutting Strategy

To generate a Time Series model, you must select a **cutting strategy** to cut your training data set into the three sub-sets: estimation, validation and test. Since the order of the observations in the data set is important for the modeling, only two types of cutting strategies are available in Time Series :

- *Sequential with Test*
- *Sequential without Test*

For more information on Cutting Strategies, see the **InfiniteInsight® - User Guide**.

For this Scenario

Do not change the cutting strategy by default.

To Select a Cutting Strategy

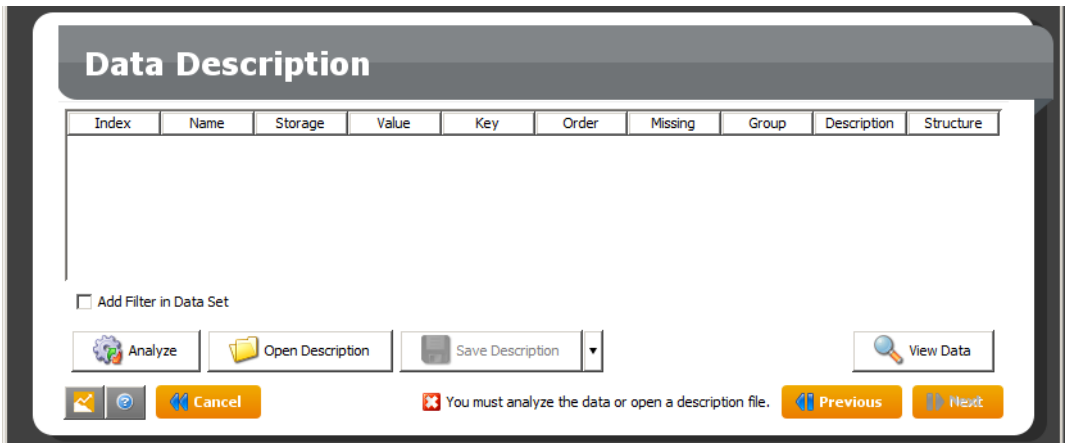
1 On the screen *Select a Data Source*, click the button *Cutting Strategy...* The panel *Cutting Strategy* is displayed.

2 In the *Predefined* list, select the cutting strategy you want to use.

3 Click the *OK* button.

4 Back to the panel *Select a Data Source*, click the *Next* button.

5 The screen *Data Description* appears.



6 Go to the section **Describing the Data Selected**.

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3.2.3 Describing the Data Selected

To describe your data, you can:

- Either **use an existing description file**, that is, taken from your information system or saved from a previous use of SAP InfiniteInsight® features,
- Or **create a description file using the** *Analyze* **option**, available to you in SAP InfiniteInsight® modeling assistant. In this case, it is important that you validate the description file obtained. You can save this file for later re-use.

Caution

The description file obtained using the *Analyze* option results from the analysis of the first 100 lines of the initial data file. In order to avoid all bias, we encourage you to mix up your data set before performing this analysis.

Why Describe the Data Selected?

In order for SAP InfiniteInsight® features to interpret and analyze your data, the data must be described. To put it another way, the description file must specify the nature of each variable, determining their:

- **Storage** format: number (*number*), integer (*integer*), character string (*string*), date and time (*datetime*) or date (*date*).
- **Type:** *continuous*, *nominal*, *ordinal* or *textual*.

For more information about data description, see the **InfiniteInsight® - User Guide**.

A Comment about Database Keys

For data and performance management purposes, the data set to be analyzed must contain a variable that serves as a key variable. Two cases should be considered:

- If the initial data set **does not contain a key variable**, a variable index *KxIndex* is automatically generated by *InfiniteInsight® Modeler – Time Series*. This will correspond to the row number of the processed data.
- If the file **contains one or more key variables**, they are not recognized automatically. You must specify them manually in the data description. See the procedure **To Specify that a Variable is a Key**. On the other hand, if your data is stored in a database, the key will be automatically recognized.

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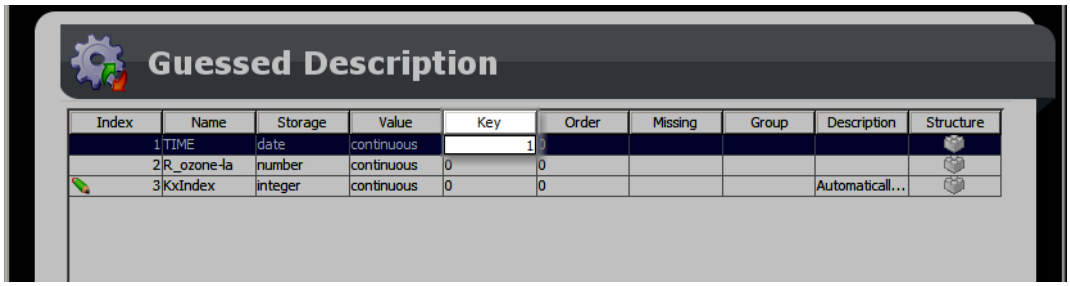
To Specify that a Variable is a Key

1 In the *Key* column, click the box corresponding to the row of the key variable.

2 Type in the value "*1*" to define this as a key variable.

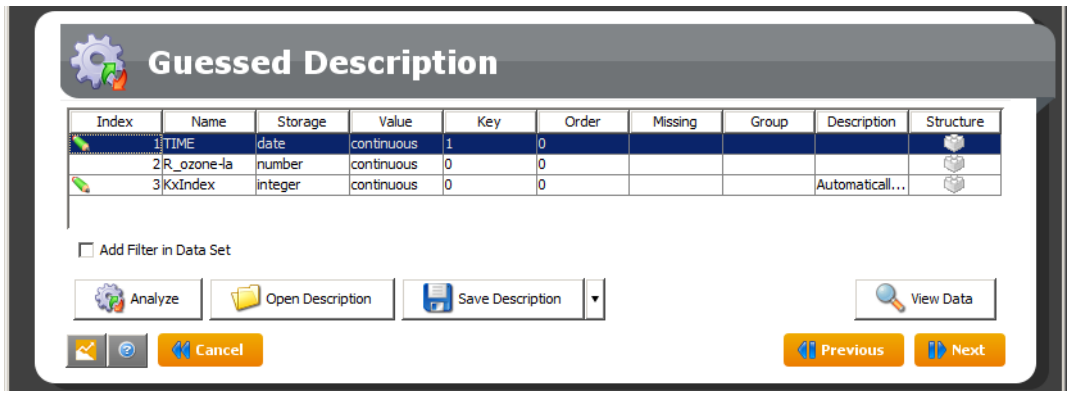

Guessed Description
Index Name Storage Value Key Order Missing Group Description Structure
1 TIME date continuous 1 0
2 R_ozone-la number continuous 0 0
3 KxIndex integer continuous 0 0 Automaticall...

For this Scenario

- Select *Text Files* as the file type.
- Use the *Analyze* function to describe the *R_ozone-la.txt* data file.
- Set the *TIME* variable as the key.
- Set the *KxIndex* variable Key to 0.
- Set the *TIME* variable Order to 1.

To Analyze a Data File

1 On the screen *Data Description*, click the *Analyze* button. The file description is displayed.



2 Validate the description (storage type and value).

3 Click the *Next* button.

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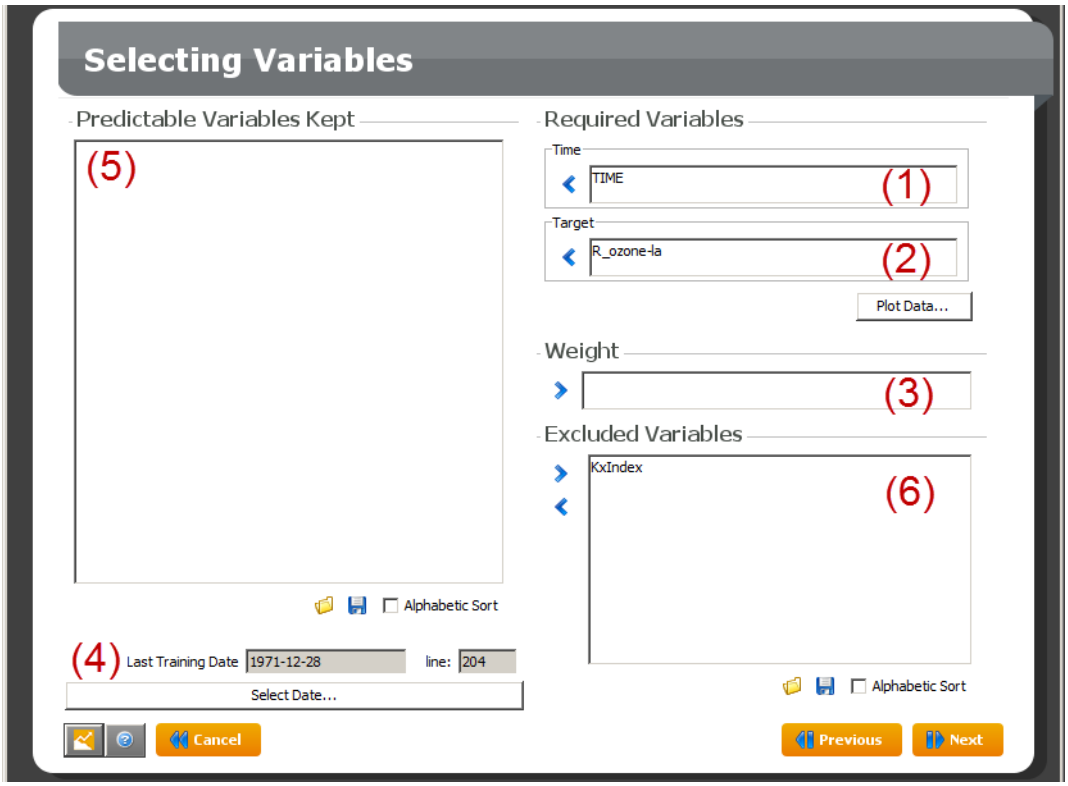
3.2.4 Selecting Variables

The panel *Selecting Variables* allows you to:

- select the time variable *(1)*,
- select the target variable *(2)*,
- select a weight variable (optional) *(3)*,
- set the last date to use for training the model *(4)*,
- select which variables should be kept for the modeling *(5)* and which should be excluded *(6)*.



For this Scenario

- Keep *TIME* as the time variable.
- Keep *R_ozone-la* as the target variable.
- Do not select a weight variable.
- Keep the last training date selected by default.

To Select a Time Variable

1 On the screen *Selecting Variables*, in the section *Predictable Variables Kept* (left hand side), select the variable you want to use as the time variable.

2 Click the button > located on the left of the *Time* field in section *Required Variable* (upper right hand side). The variable moves to the *Time* field.

Note

To remove the time variable, select the variable in the *Time* field and click the button < to move the variables back to the screen section *Predictable Variables Kept*.

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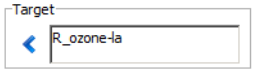
☑ To Select a Target Variable

1 On the screen *Selecting Variables*, in the section *Predictable Variables Kept* (left hand side), select the variable you want to use as the Target Variable.

2 Click the button > located on the left of the *Target* field in section *Required Variable* (upper right hand side).
The variable moves to the *Target* field.



> **Note**
>
> To remove the target variable, select the variable in the *Target* field and click the button < to move the variables back to the screen section *Predictable Variables Kept*.

☑ To Select a Weight Variable

1 In the field *Predictable Variables Kept*, select the weight variable.

2 Click the > button located on the right of the *Weight* field.

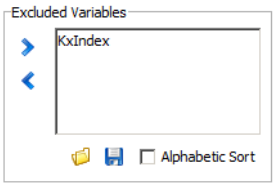
> **Note**
>
> To remove the weight variable, select the *Weight* field and click the < button.

☑ To Exclude Variables

1 In the field *Predictable Variables Kept* (left hand side), select the variables you want to exclude.

> **Note**
>
> To select all the variables of a field, click inside the field and push the keys Ctrl and A at the same time.

2 Click the > button located near the top right corner of the field *Excluded Variable*



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☑ To Display the Signal

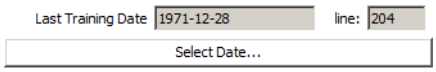
1. On the screen *Selecting Variables*, click the button *Plot Data...*, located in the section *Required Variables*. The screen *Display Signal* is displayed.
2. Click the *Time* list and select the variable containing the time information.

> **Note**
>
> By default, Time Series uses the first column of the data set as time variable.

3. Click the *Signal* list and select the variable containing the signal information.
4. Click the *Previous* button to go back to the screen *Selecting Variables*.

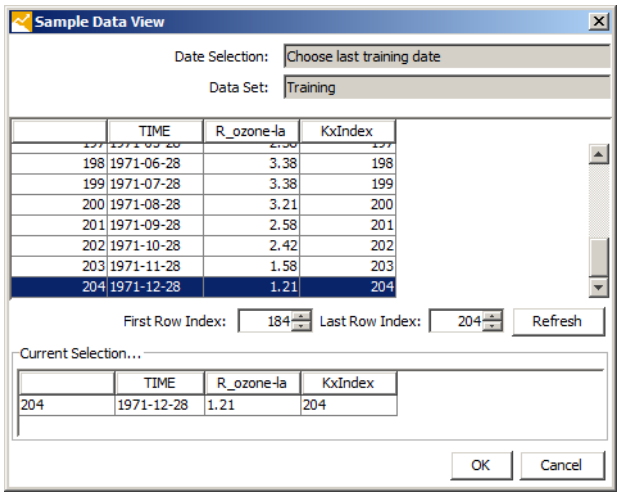
Reducing the Training Data Set

The last date found in the data set is automatically selected as the last training date. The second field, which indicates the number of the line in the data set, is automatically updated depending on the date you have selected.



☑ To Reduce the Training Data Set

1. On the screen *Selecting Variables*, click the button *Select Date...*. The panel *Sample Data View* is displayed.



2. Uses the *First Row Index* and *Last Row Index* to display the line containing the date you want to select as the last training date.
3. Click the *Refresh* button to update the list of rows displayed.
4. Click the row corresponding to the date you want to select. The selected row is displayed in the section *Current Selection* at the bottom of the panel.
5. Click the *OK* button to validate your selection. The window closes and the *Last Training Date* information are updated in the main panel.

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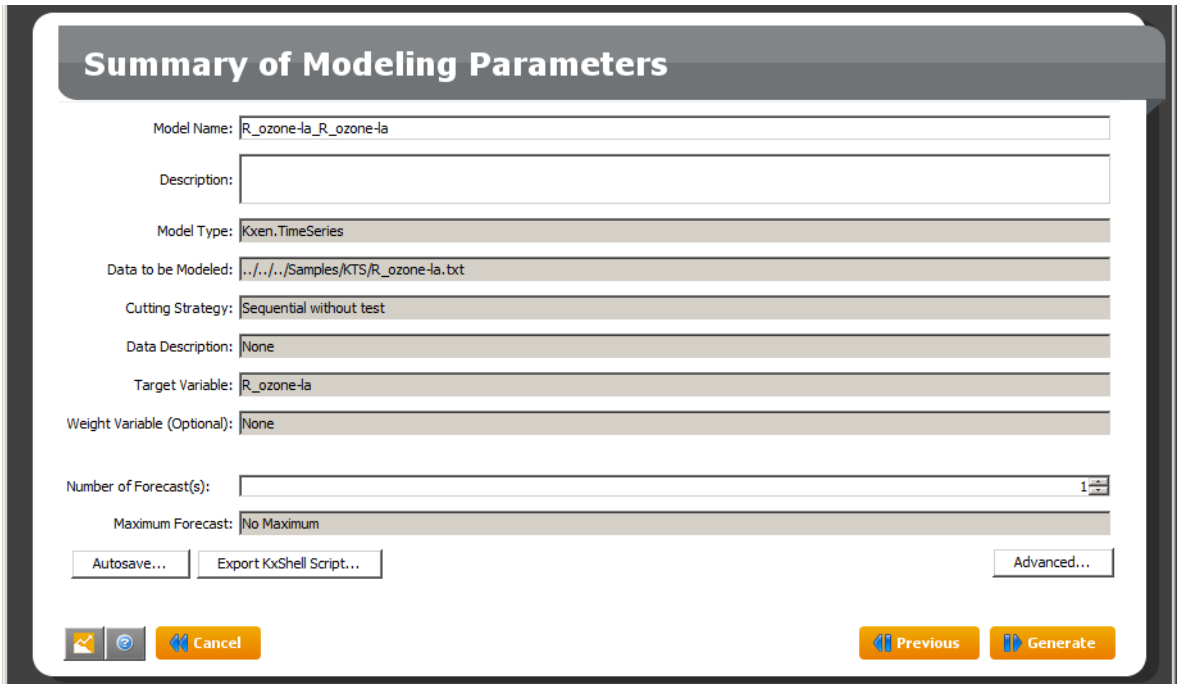
3.2.5 Checking Modeling Parameters

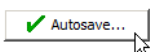
The screen *Summary of Modeling Parameters* allows you to check the modeling parameters just before generating the model.



- The name of the model is filled automatically. It corresponds to the name of the target variable (*R_ozone-la* for this scenario), followed by the underscore sign ("_") and the name of the data source, without its file extension (*R_ozone-la* in this case)
- The field *Number of Forecast(s)* allows you to select the number of forecasts to generate. The time unit used is determined by the data analyzed. For example, if the data set observations are recorded monthly, the time unit will be one month. See section Defining the Number of Forecasts (on page 20).

The maximum number of forecasts allowed is indicated in the field *Maximum Forecast*. This number depends on the number of extra predictable variables available. If there is no extra predictable variables, the number of forecasts is unlimited.

- The *Autosave* button allows you to activate the feature that will automatically save the model once it has been generated. When the autosave option is activated, a green check mark is displayed on the *Autosave* button.



Defining the Number of Forecasts

For this Scenario

Define the number of forecasts to **24**, that is, two years.

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☑ To Define the Forecasts Number

On the screen *Summary of Modeling Parameters*, in the field *Number of Forecast(s)*, enter the number of forecasts you want to obtain.

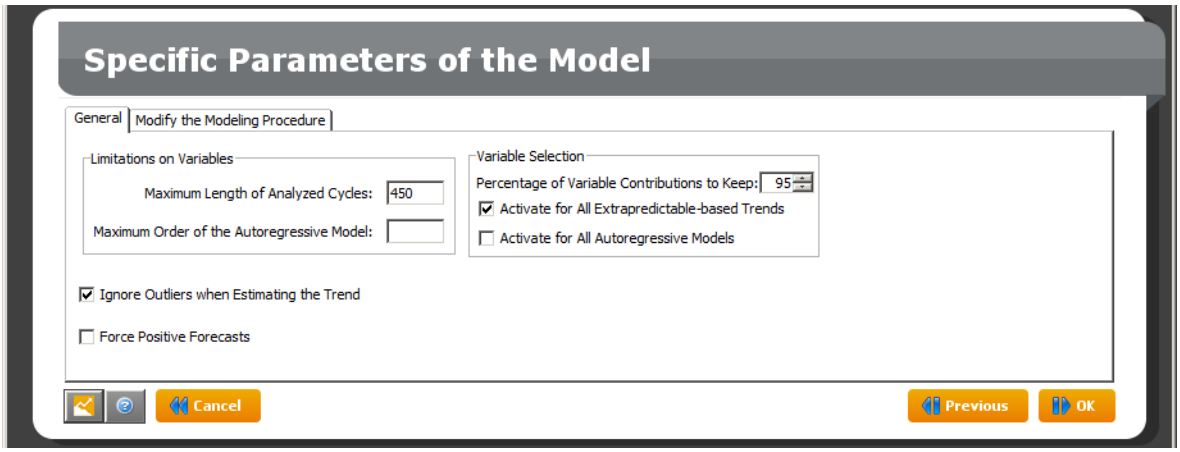
Defining the Advanced Parameters

The advanced parameters allow you to:

- limit the number of analyzed variables,
- define the modeling procedure.

☑ To Define the Advanced Parameters

1 Click the *Advanced* button. The panel *Specific Parameters of the Model* is displayed.



2 Set the parameters as explained in the following sections.

3 Click the *OK* button to save the new parameters. The panel *Summary of Modeling Parameters* is displayed.

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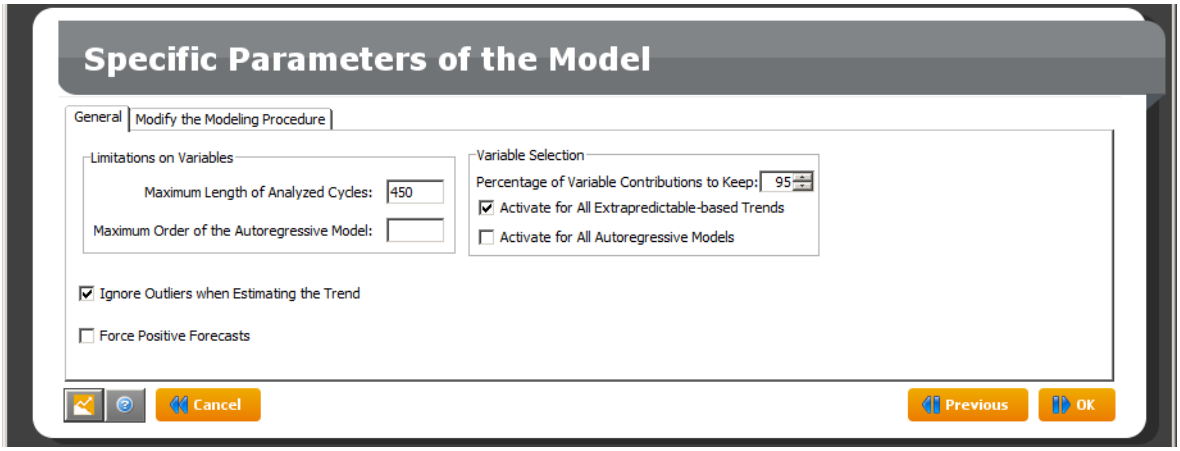
Defining the Number of Analyzed Variables (optional)

Time Series automatically generates the variables that necessary to the modeling. Among these, it is possible to reduce the number of the cyclic variables by changing the parameter *Maximum Length of Analyzed Cycles* and the lagged variables created by changing the parameter *Maximum Order of the Autoregressive Model*.



- The *Maximum Length of Analyzed Cycles* controls the way Time Series analyzes the periodicities in the signal. This is the length of the longest cycle Time Series will try to detect. The default value is 450. It is also limited by the size of the estimation data set. You can disable the cyclics analysis by setting this parameter to zero.

By reducing the default number of variables generated by Time Series, you are able to reduce the computation time. However it is strongly recommended to use the default settings otherwise the quality of modeling could be compromised.

- The *Maximum Order of the Autoregressive Model* controls the way Time Series analyzes the random fluctuations in the signal. This parameter defines the maximum dependency of the signal on its own past values. You can set this parameter to zero to disable the fluctuations analysis.

Defining the Other Modeling Options

The *Ignore Outliers when Estimating the Trend* checkbox uses a strategy for reducing the effect of outliers when estimating the regressions in deterministic trends. This leads to an improvement in trend estimation.

The *Force Positive Forecasts* checkbox allows users to force Time Series to generate a positive model (with positive forecasts only).

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Defining the Variables

This parameter groups some controls for the variable selection feature. When a variable selection is used, an automatic selection process is performed on trends or AR models during the competition and the result is kept only if it improves the final model.

- The *Percentage of Variable Contributions to Keep* is the percentage of contributions that are kept in the automatic selection process. The default value is 95%.
- The *Activate for All Extra-predictable Based Trends* option performs a variable selection on all extrapredictable-based trends. User variables are kept only if they have sufficient contributions in the trend regression. The checkbox is enabled by default.
- The *Activate for All Autoregressive Models* option performs an automatic variable selection on the past values of the signal for all autoregressive models. This leads to a more parsimonious AR model, that is a simpler model and a lower order. The box is not checked by default.

Modifying the Modeling Procedure

Four types of modeling procedure are available:

- *Default*, which corresponds to the standard Time Series modeling.
- *Based on Extra-Predictable Variables*, which works as a Classification/Regression model build on the extra-predictable variables with the signal as the target. This mode can be used to refine and validate the extra-predictable variables or to identify the useless ones.
- *Disable the Polynomial Trends*, which generates all the models but those containing a polynomial trend.
- *Customized*: gives the possibility to enable/disable the types of models that will be generated by Time Series when analyzing the signal. The following table lists the types of models that can be disabled.

Component	Model Type	Description
Trends	*Lag1*	Previous value of the signal
	Lag2	Value before previous
	Linear in Time	Linear regression on the time
	Polynomial in Time	Polynomial regression on the time
	Linear in ExtraPredictables	Linear regression on the extra-predictable variables
	Linear in Time and Linear in ExtraPredictables	Linear regression on the time and extra-predictable variables
	Polynomial in Time and Linear in ExtraPredictables	Polynomial regression on the time and linear regression on the extra-predictable variables
Periodicities	*Cyclics*	Cyclic variable detection
	Seasonalities	Seasonal variable detection
	Periodic Extrapredictables	Extra-predictable usage as Periodics
Fluctuations	*Autoregressive*	Autoregressive modeling

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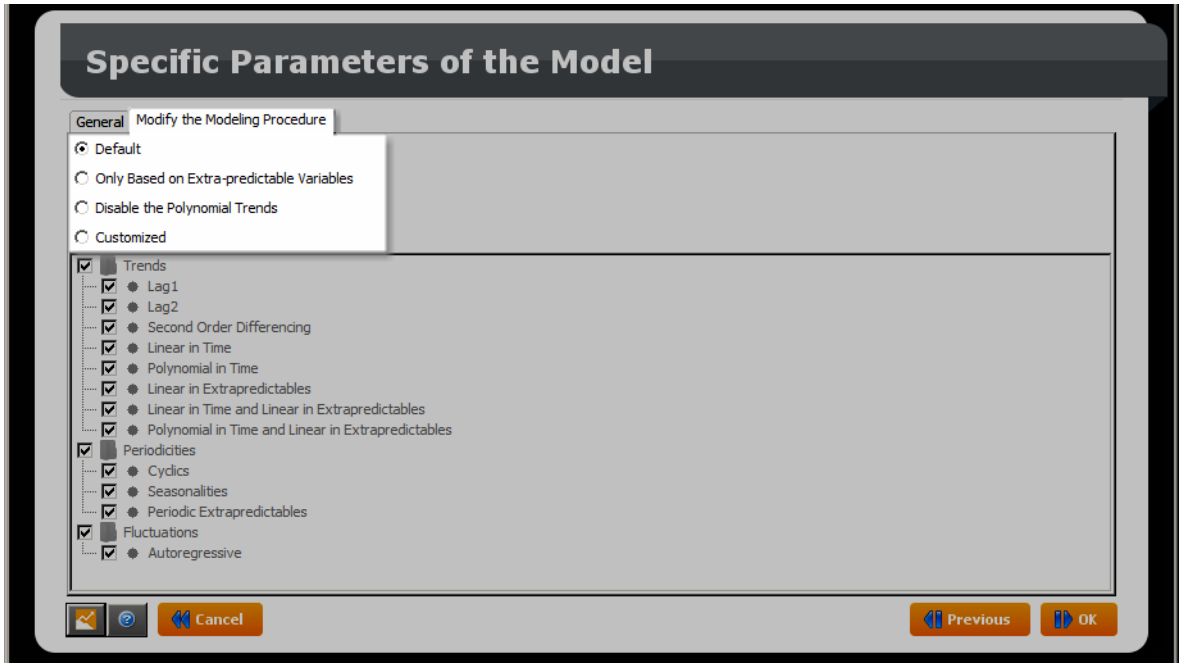
☑ To Modify the Modeling Procedure

1 In the section *Modify the Modeling Procedure*, check the desired option.



2 If you have selected the *Customized* option, uncheck the types of models you want to disable.

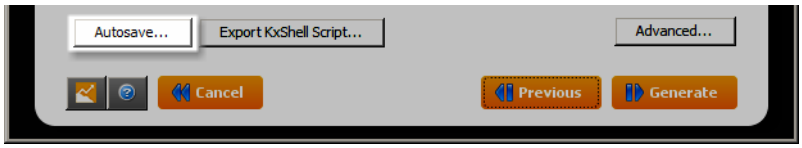
3 Click the *OK* button. The panel *Summary of Modeling Parameters* is displayed.

Activating the Autosave Option

The panel *Model Autosave* allows you to activate the option that will automatically save the model at the end of the generation process and to set the parameters needed when saving the model.

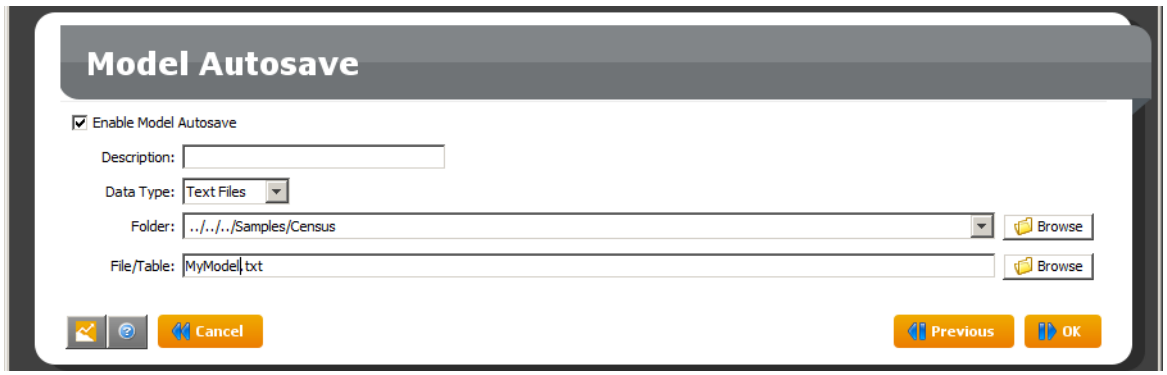
☑ To Activate the Autosave Option

1 In the panel *Summary of Modeling Parameters*, click the *Autosave* button.



The panel *Model Autosave* is displayed.

2 Check the option *Enable Model Autosave*.



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3 Set the parameters listed in the following table.

Parameter	Description
Model Name	This field allows you to associate a name with the model. This name will then appear in the list of models to be offered when you open an existing model.
Description	This field allows you to enter the information you want, such as the name of the training data set used, the polynomial degree or the KI and KR performance indicators obtained. This information could be useful to you later for identifying your model. *Note* - This description will be used instead of the one entered in the panel *Summary of Modeling Parameters*.
Data Type	this list allows you to select the type of storage in which you want to save your model. The following options are available: ▪ *Text files*, to save the model in a text file. ▪ *Database*, to save the model in a database. ▪ *Flat Memory*, to save the model in the active memory. ▪ *SAS Files*, to save the model in a SAS compatible file for a specified version of SAS and a specified platform (SAS v6 or 7/8 for Windows or UNIX). ▪ *SAS Transport*, to save the model in a generic SAS compatible file.
Folder	Depending upon which option you selected, this field allows you to specify the ODBC source, the memory store or the folder in which you want to save the model.
File/Table	This field allows you to enter the name of the file or table that is to contain the model. The name of the file must contain one of the following format extensions `.txt` (text file in which the data is separated by tabs) or `.csv` (text file in which the data is separated by commas).

4 Click *OK*.

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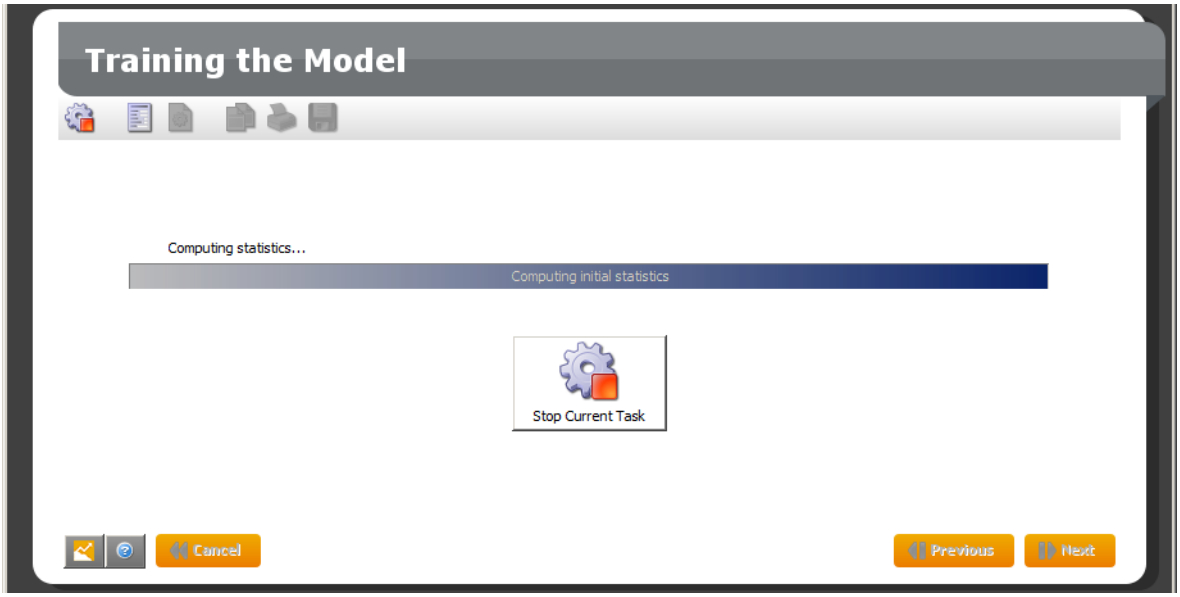
3.3 Step 2 - Generating the Model

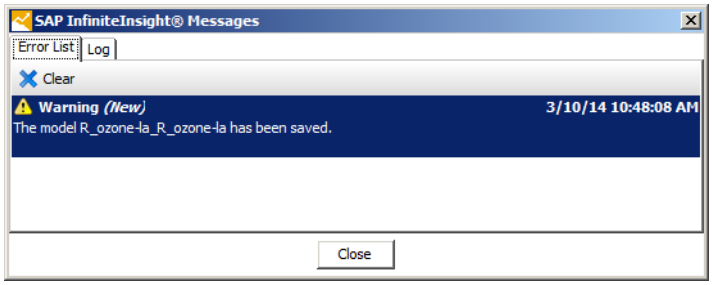
Once the modeling parameters are defined, you can generate the model.

☑ To Generate the Model

1 On the screen *Summary of Modeling Parameters*, click the *Generate* button.
The screen *Training the Model* appears. The model is being generated. A progress bar allows you to follow the process.



2 If the *Autosave* option has been activated in the panel *Summary of Modeling Parameters*, a warning message is displayed at the end of the learning process confirming that the model has been saved.



3 Click *Close*.

IN THIS CHAPTER

Following the Generating Process..... 27
Visualizing the Model Results..... 28

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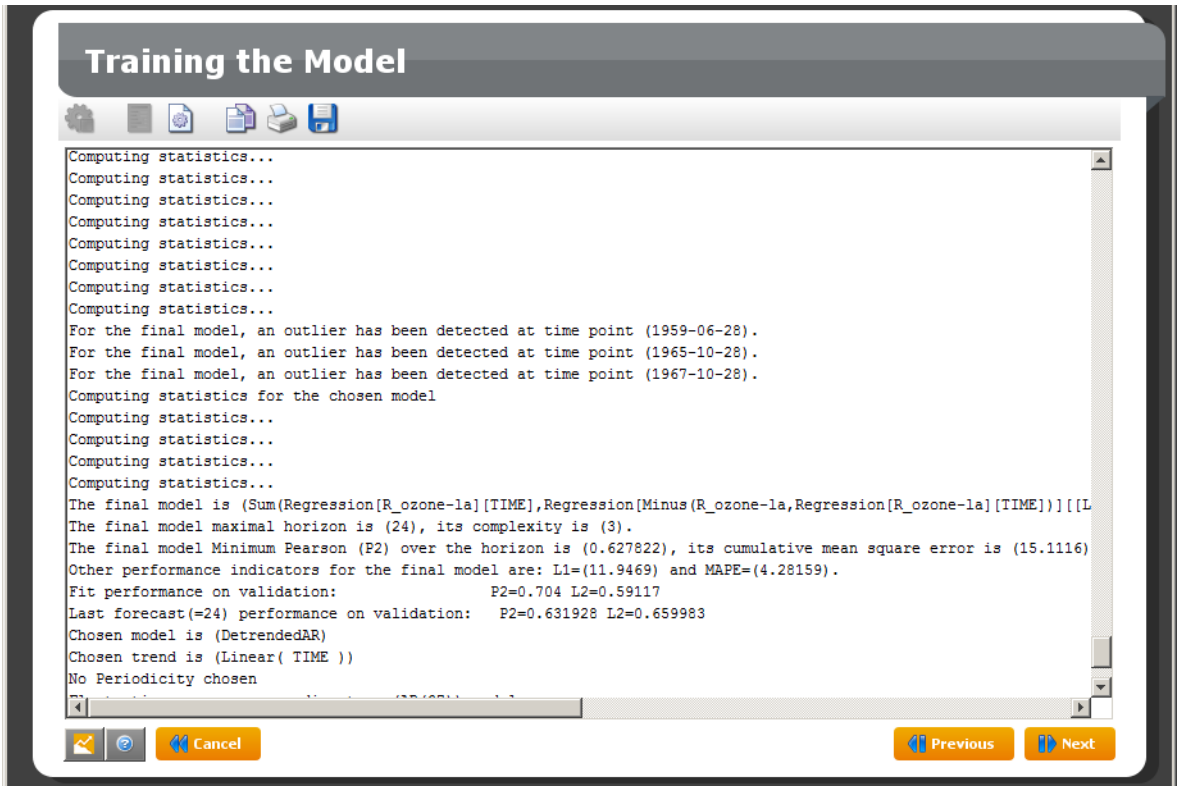
3.3.1 Following the Generating Process

There is two ways for you to follow the progress of the generation process :

- The *Progress Bar* displays the progression for each step of the process. It is the screen displayed by default.
- The *Detailed Log* displays the details of each step of the process.

☑ To Display the Detailed Log

Click the (*Show Detailed Log*) button.
The following screen appears.


Training the Model
Computing statistics...
Computing statistics...
Computing statistics...
Computing statistics...
Computing statistics...
Computing statistics...
Computing statistics...
Computing statistics...
For the final model, an outlier has been detected at time point (1959-06-28).
For the final model, an outlier has been detected at time point (1965-10-28).
For the final model, an outlier has been detected at time point (1967-10-28).
Computing statistics for the chosen model
Computing statistics...
Computing statistics...
Computing statistics...
Computing statistics...
The final model is (Sum(Regression[R_ozone-la][TIME],Regression[Minus(R_ozone-la,Regression[R_ozone-la][TIME])][[L
The final model maximal horizon is (24), its complexity is (3).
The final model Minimum Pearson (P2) over the horizon is (0.627822), its cumulative mean square error is (15.1116)
Other performance indicators for the final model are: L1=(11.9469) and MAPE=(4.28159).
Fit performance on validation: P2=0.704 L2=0.59117
Last forecast(=24) performance on validation: P2=0.631928 L2=0.659983
Chosen model is (DetrendedAR)
Chosen trend is (Linear(TIME))
No Periodicity chosen
Cancel
Previous
Next

☑ To display the Progression Bar

Click the (*Show Progression*) button.
The progression bar screen appears.

☑ To Stop the Learning Process

1 Click the (*Stop Learning Process*) button.
2 Click *Previous*.
The screen *Summary of Modeling Parameters* appears.
3 Go back to the section **Checking Modeling Parameters**.

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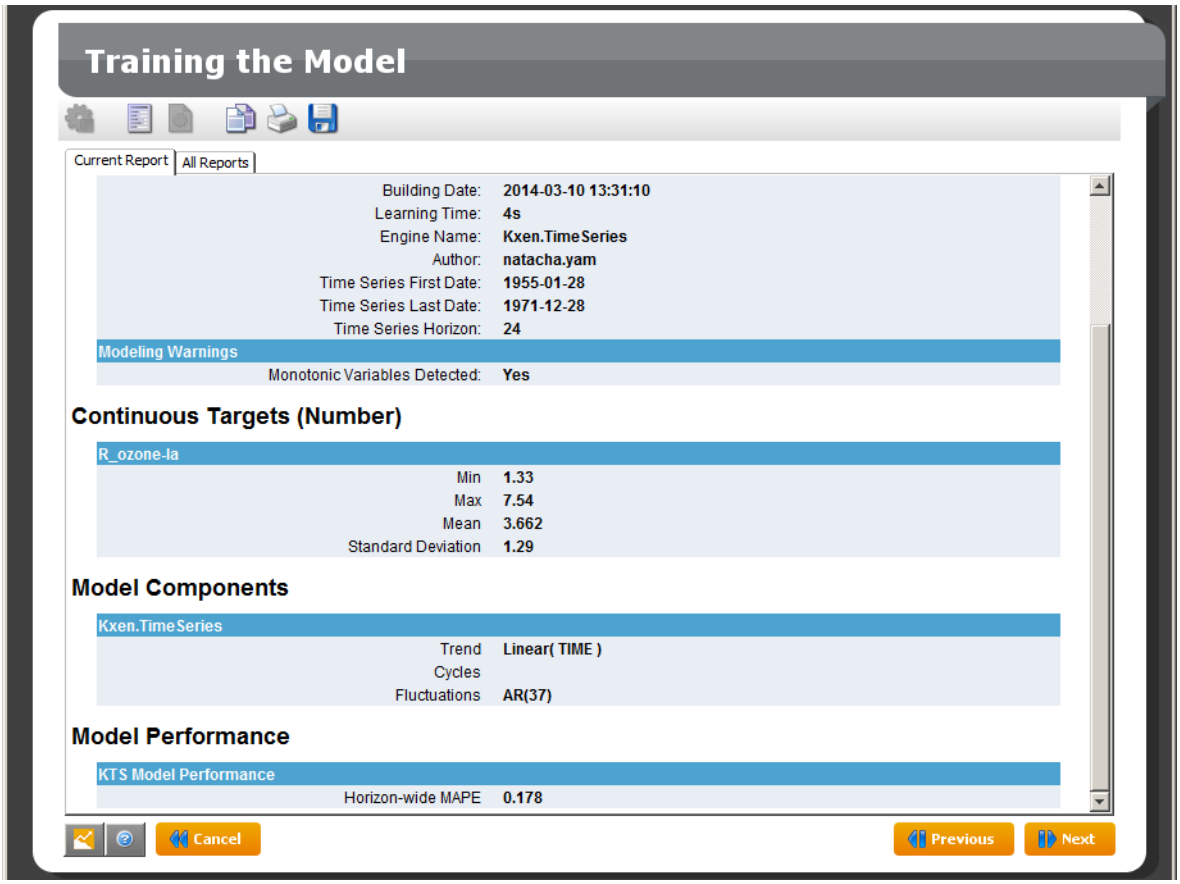
3.3.2 Visualizing the Model Results

At the end of the generation process, a summary of the model results appears.



If you have built more than one model in the same session, all model debriefing will be displayed on this screen sorted by Date of Build.

For more information on the model summary, go to section **Understanding the Model Debriefing**.

Caution

In some cases, the message No Model Found is displayed instead of the signal information. It means that none of the models found can predict accurately the signal evolution.

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3.4 Step 3 - Analyzing and Understanding the Generated Model

The suite of plotting tools within the SAP InfiniteInsight® allows you to analyze and understand the model generated:

- The **performance of the model**,
- The **forecasts** generated by the model.

IN THIS CHAPTER

Model Debriefing 30
Forecasts 35
Signal Components 40
Regressions: Contribution by Variables 45
Statistical Reports 46

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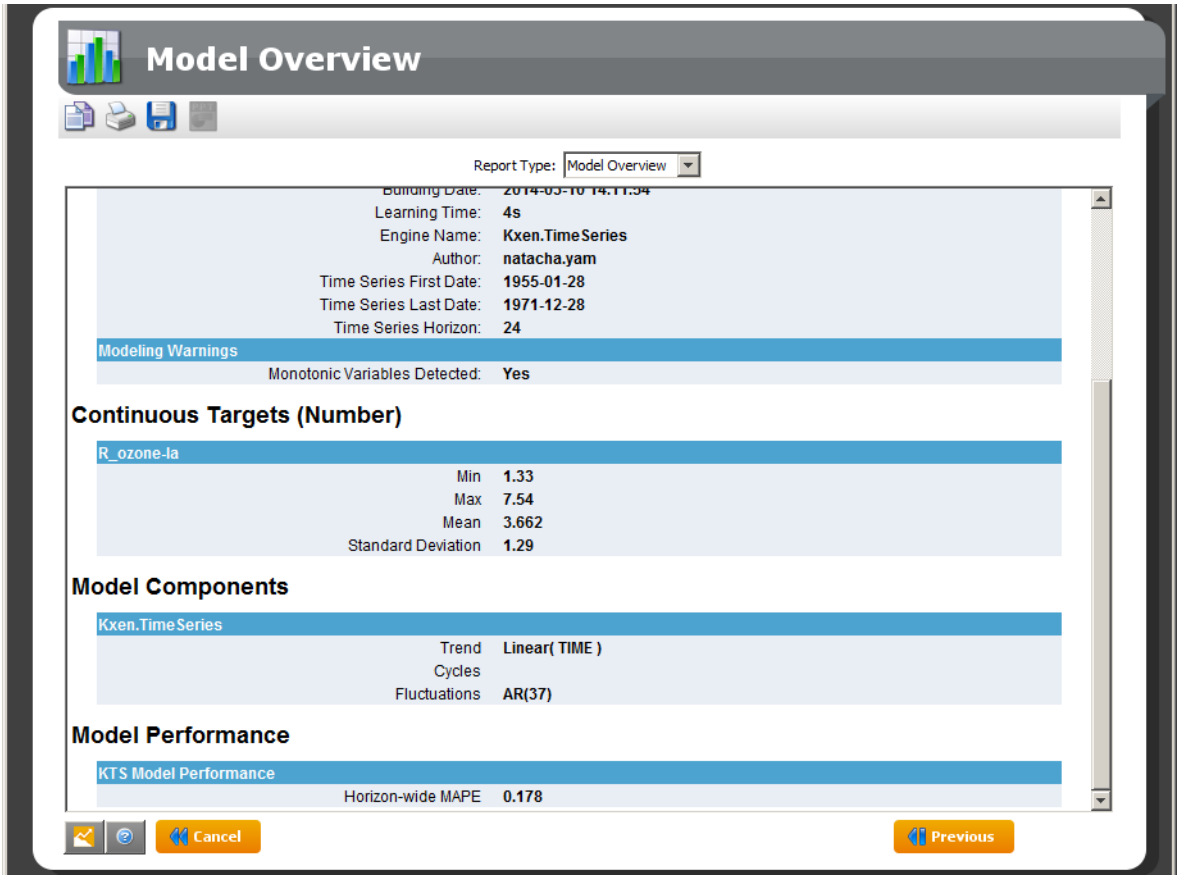
3.4.1Model Debriefing

☑ To Display the Model Debriefing

1 On the *Using the Model* menu, select the *Model Overview* option.
The screen *Model Overview* appears.



Note

If you have built more than one model in the same session, all model debriefing will be displayed on this screen sorted by *Date of Build*.

Understanding the Model Debriefing

The *Model Debriefing* screen is composed of four sections detailing information on:

- The overview of the model
- The targets statistics
- The model components
- The model performance

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The Model Overview

This section details the following information:

Name	Significance	For this scenario...
Model Name	Name of the model. It is generated by using the target variable name and the data set name	R_ozone-la_R_ozone-la
Data Set	Name of the data source used for the model	R_ozone-la.txt
Initial Number of Input Variables	Total number of variables in the data set	3
Number of Selected Variables	Number of variables used to generate the model	1
Number of Records	Number of observation in the data source file	204
Building Date	Date and time when the model was build	2014-03-10 10:51:26
Learning Time	Duration of the learning process	3s
Engine Name	Name of the component used to build the model	Kxen.TimeSeries

The Targets Statistics

For continuous targets:

Name	Significance	For this scenario...
<target name>	name of the target variable for which the statistics are stated	R_ozone-la
Min	Minimum value found in the data set for the target variable	1.33
Max	Maximum value found in the data set for the target variable	7.54
Mean	Mean of the target variable	3.662
Standard Deviation	Measure of the extent to which the target values are spread around their average	1.29

The Signal Components

This section details the model components, that is the components of the polynomial used to generated the forecasts.

A model is a combination of at least one of the three following types of elements:

- one **trend**,
- one or more **cycles**,
- one **fluctuation**.

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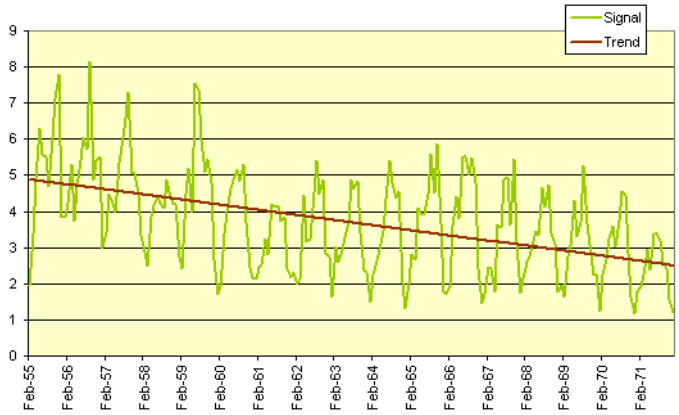
The Trend

The trend is the general orientation of the signal. The four types of trends are detailed in the following table:

Type of trend	Can be displayed as...
Polynom(Time)	a curve corresponding to the detected polynomial. A polynomial is modeled using Classification/Regression. The available functions for the polynomial are Time, square(Time), sqrt(Time), where Time equals the value of the *DateColumnName* parameter.
Polynom(Time, ExtraPredictable)	a curve corresponding to the detected polynomial. This is the same function using in addition the extra predictable variables as inputs.
Linear(Time)	a straight line. It is a special case of *Polynom(Time)*.
Linear(Time, ExtraPredictables)	a straight line. This is the same function using in addition the extra predictable variables as inputs.
Polynom (ExtraPredictables)	a curve corresponding to the detected polynomial. This function could be very next to a cyclic representation because Classification/Regression is only using the extra-predictable variables as inputs.
L1	the signal moved one step forward. This is the basic forecast where the predicted observation equals the latest signal observation.
L2	the signal moved two step forward.

For this scenario

The trend found in the signal is a *Linear(TIME)*. The following graph shows the trend compared with the signal.



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The Cycles

The cycles are periodic elements that can be found at least twice in the *Estimation* data set. The two types of cycles are detailed in the following table:

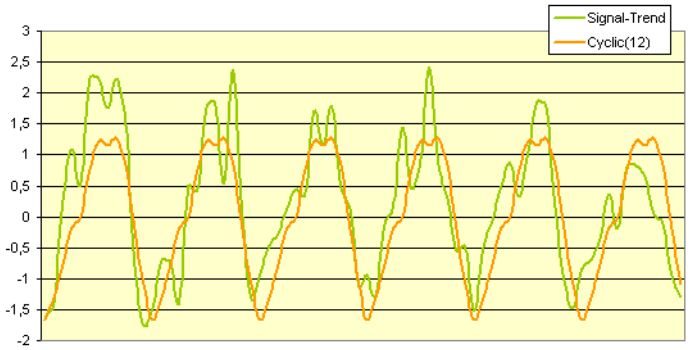
Type of cycle	Description
Periodic	a cycle not depending on the date. A periodic is defined by the number of time units it covers.
Seasonal	a cycle depending on the date or time. For example, the day of the month, the hour of the day, and so on. Note - Time Series can automatically detect the following seasonal variables: dayOfWeek, dayOfMonth, dayOfYear, weekOfYear, monthOfYear, hourOfDay.

For this scenario

No periodic has been detected for this scenario.

The following graph presents an example of two periodics found in the signal:

- A *monthOfYear* cyclic representing 12 months, that is a periodic of one year. The following graph presents this cycle compared with part of the signal once the trend has been extracted.



A *Cyclic(52)* representing 52 months, that is a periodic of about four years.

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The Fluctuation

The fluctuation is what is left when the trend and the cycles have been extracted. It is modeled with an auto-regression that uses a window of past data to model the current residue. The number of observations in the window is determined by Time Series depending on the total number of observations in the Estimation data set.

For this scenario

Fluctuations have been detected for this scenario.

The following graph presents the auto-regression. The orange area represents the window of past observations which are based on the past 37 months. The point in the red circle is the point calculated by the auto-regression.

The Residuals

The residuals is what is left when the trend, the cycles and the fluctuation have been extracted from the signal. This part called white noise and made of random elements that cannot be modeled.

The Outliers

The outliers are points where the predictive curve is very distant from the real curve. They are represented by a red square on the plot. An outlier is detected when the absolute value of the residuals is over twice the standard deviation computed on the Estimation data set.

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The Model Performance

This section gives the model performance.

Name	Significance	For this Scenario
Horizon-Wide MAPE	This quality indicator for the forecasting model is the mean of MAPE values observed over all the training horizon. A value of zero indicates a perfect model while values above 1 indicate bad quality models. A value of 0.09 means that the model takes into account 91% of the signal or , in other words, the forecasting error (model residues) is relatively of 9%. *MAPE - Mean Absolute Percentage Error*: The MAPE value is the average of the sum of the absolute values of the percentage errors. It measures the accuracy of the model's forecasts and indicates how much the forecasts differ from the real signal value.	0.178

3.4.2 Forecasts

☑ To Display the Forecast Plot

1. On the *Using the Model* Menu, click the *View Forecasts* option.
2. A pop-up is displayed asking you to confirm or update the name and location of the training data set file.
3. Update the information if you have renamed or moved the training data set file, or if its type has been changed.

> **Note**
>
> Steps 2 and 3 are required in case you open a saved model and the data set used to train it has been moved, for example.

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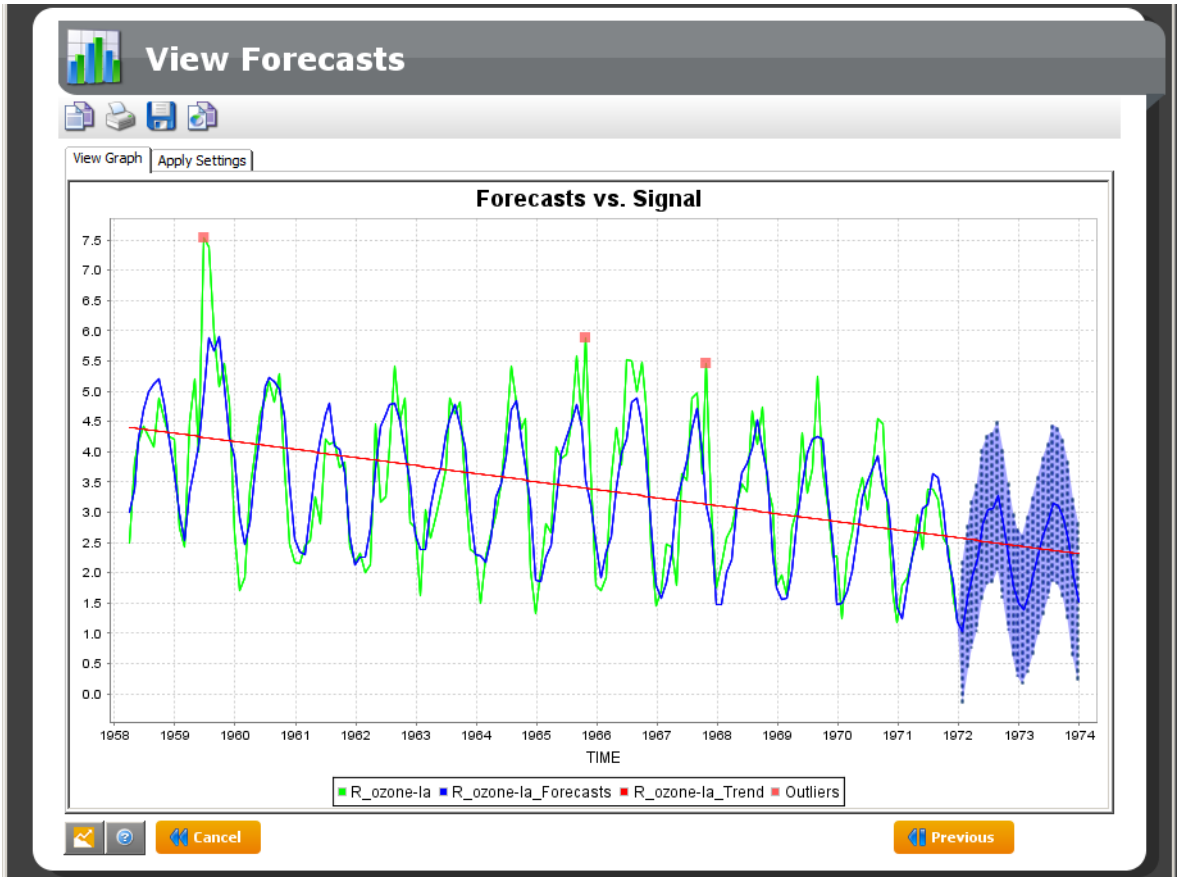
4 Click *OK*.
The screen *View Forecasts* appears.



Note

When you copy and paste this graph, the confidence interval information are not made available. To get this information, you can go to *Tables Debriefing* > *Error Bars*. The interval lower bound equals the signal value minus two times the value of the error bar and the upper bound equals the signal value plus two times the value of the error bar.

Displaying the Apply Plot

The panel *Apply Settings* allows you to graphically preview the results of an apply of your model on a new data set.

Note

Be aware that this feature does not generate any output files apart from the graph. To generate an output file, see Step 4 - Applying the Model (see "Applying the Model" on page 49).

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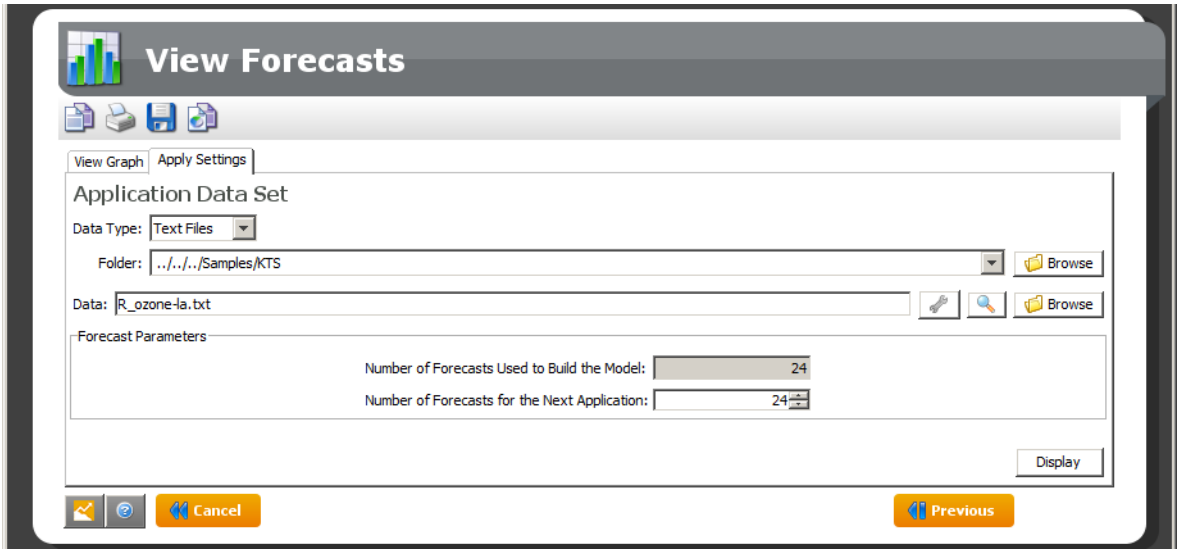
☑ To Display the Apply Results Graph

1 Select the tab *Apply Setting*. The following panel is displayed.



2 Select the data source type in the *Data Type* drop-down list (Text Files, Data Base, Flat Memory, ...)

3 In the *Folder* field, select the folder or data base where the apply data is located.

4 In the *Data* field, select the file or table containing the apply data.

5 In the section *Forecasts Parameters*, set the number of forecasts to use for the application.
As an indication, the number of forecasts used to build the model is displayed in a non-modifiable field.

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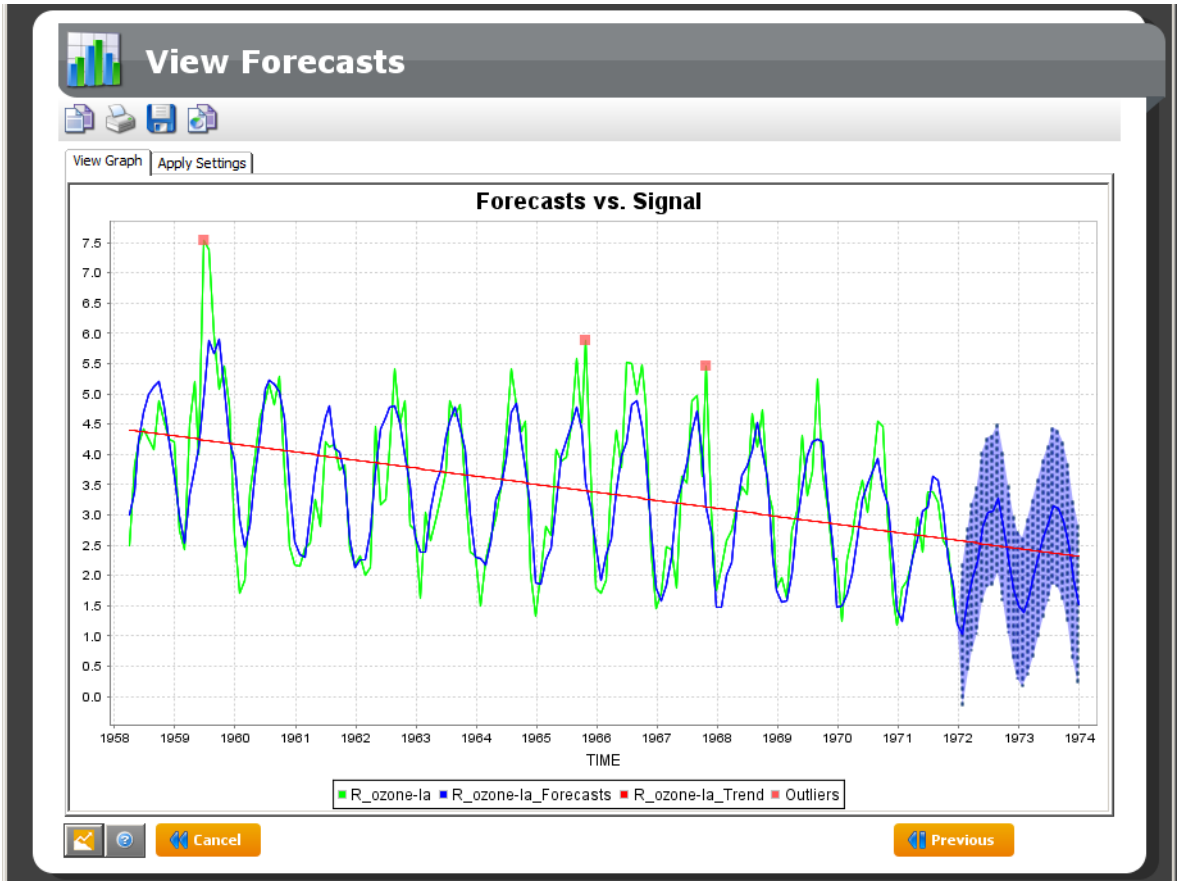
6 Click the *Display* button to visualize the graph resulting from the application of the model on the new data.



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Understanding the Forecast Plot

The Forecast plot allows you to visualize five types of information:

- The **signal**
- The **predicted signal**
- The **trend**
- The **error bars**
- The **outlier**

The following table describes each graphical element and its signification:

Element	Symbolized by...	Represents...
Signal	The green curve	The information contained in the training data set
Predicted Signal	The blue curve	The signal predicted by the generated model
Trend	The red curve	The signal trend. This curve is only displayed if the trend is a polynomial or a linear. For more information on the trend, see section **The signal components** (on page 31)
Error Bars	The blue area around the end of the blue curve	The zone of possible error where the predicted signal could be. The error bars are only displayed for the forecasts. *Note* - The error bars are equal to twice the standard deviation computed on the Validation data set.
Outlier	A red square	A point where the predictive curve is very distant from the real curve. *Note* - An outlier is detected when the absolute value of the residuals is over twice the standard deviation computed on the Estimation data set.

As long as the original signal is displayed, you can measure the accuracy of the predicted signal against the original one. When the original signal stops, the error bars allow you to measure the level of confidence of the predicted signal. The error bars are not displayed further than the first forecast for which the model cannot guarantee the accuracy of the predicted signal. In other words, when the model cannot evaluate if its prediction is correct, it stops displaying the error bars.

Note

If you have selected the *Sequential* cutting strategy, the error bars are displayed on the test part of the signal.

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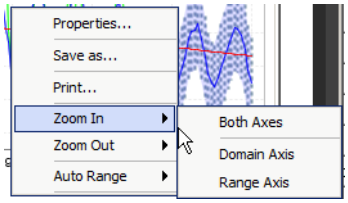
☑ To Zoom the Plot In/Out

1 Right-click the plot area you want to zoom in or out.
A contextual menu appears.

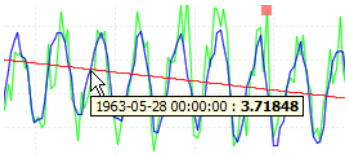


2 Select the type of zoom you want to apply.

3 Select on which axes you want to zoom. Note that the point where you click is the central point of the zoom.

☑ To Display the Value of a Specific Element of a Signal

Place your cursor on a selected point of a signal curve.
A pop-up displays the information for this point of the signal.



3.4.3 Signal Components

☑ To Display the Signal Components

1 On the menu *Using the Model*, click the option *View Signal Components*.

2 A pop-up is displayed asking you to confirm or update the name and location of the training data set file.

3 Update the information if you have renamed or moved the training data set file, or if its type has been changed.

> **Note**
>
> Steps 2 and 3 are required in case you open a saved model and the data set used to train it has been moved, for example.

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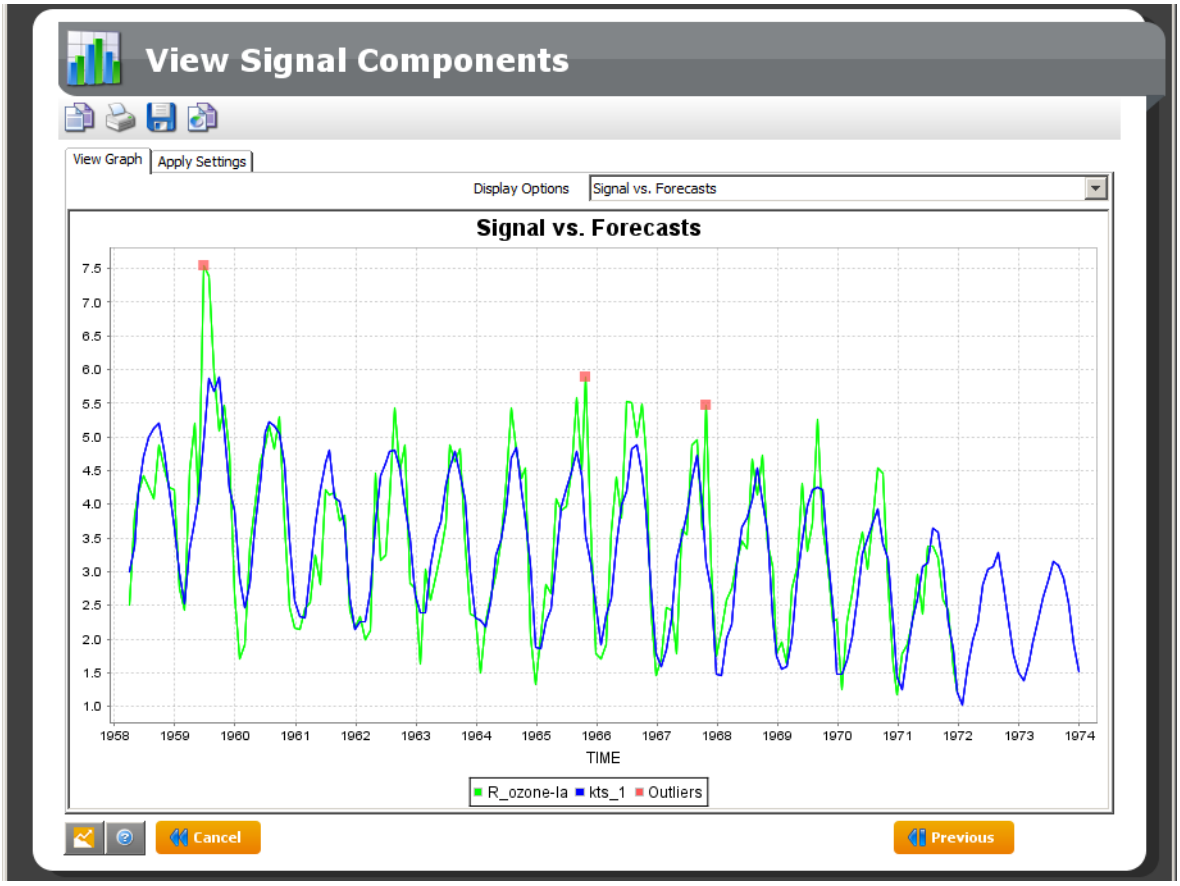
4 Click *OK*.
The screen *View Signal Components* appears.



5 In the list *Display Options*, select the component you want to display.

Understanding the Signal Components

The signal components are ordered as listed below:

1 the trend,
2 the periodics,
3 the fluctuation,
4 the residuals,
5 the outliers.

To display a component, Time Series removes the previous existing components from the signal. For example, to display the fluctuation, Time Series removes the trend and the periodics from the signal.

More information on the signal components available in **Understanding the Model Debriefing: Signal Components** (on page 31).

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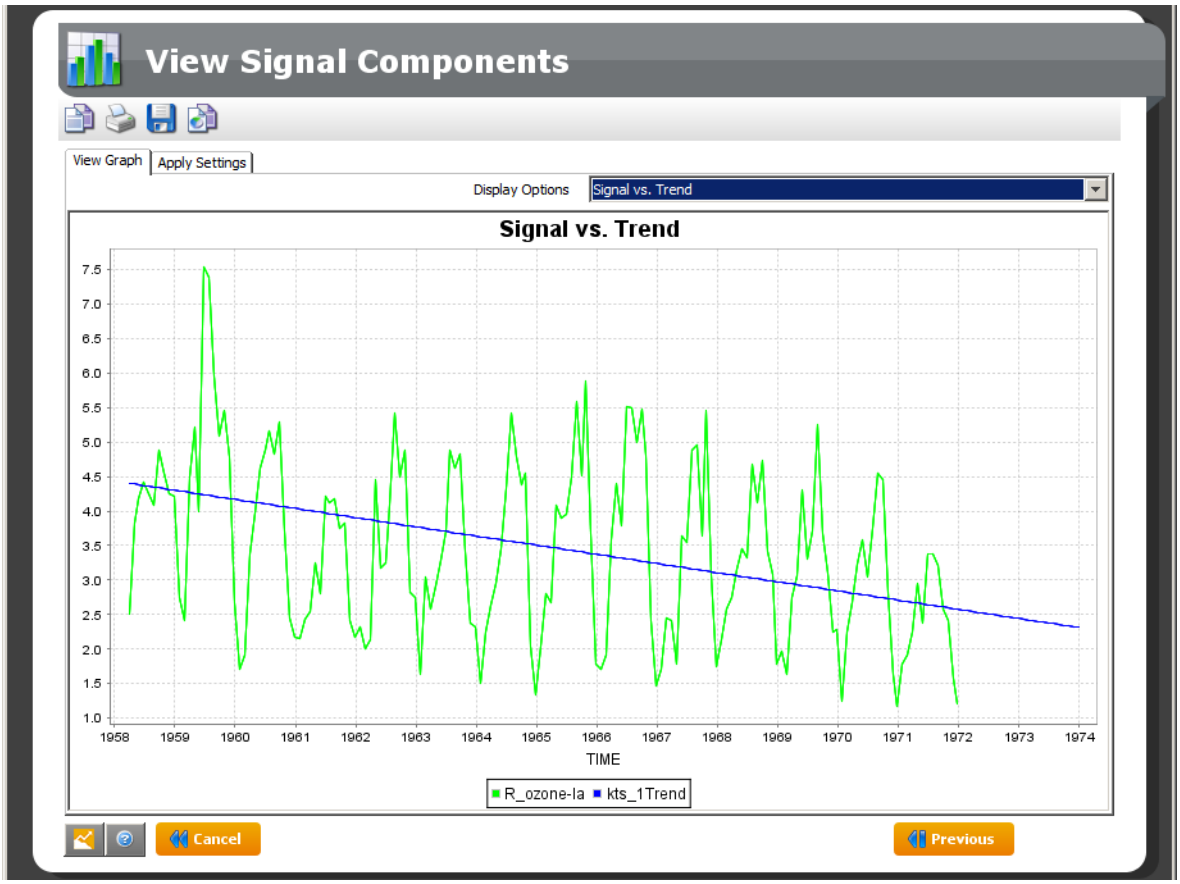
Signal vs. Trend

For this Scenario

Time Series has recognized a **descending linear trend**, it appears in blue on the plot *Signal vs. Trend*.



The detailed explanation of the trend can be found in **Understanding the Model Debriefing > Signal Components > The Trend** (see "**The Trend**" on page 32).

Signal vs. Periodics

For this scenario

The model has not found any periodic.

A detailed explanation of the periodics can be found in section **Understanding the Model Debriefing > Signal Components > The Cycles**.

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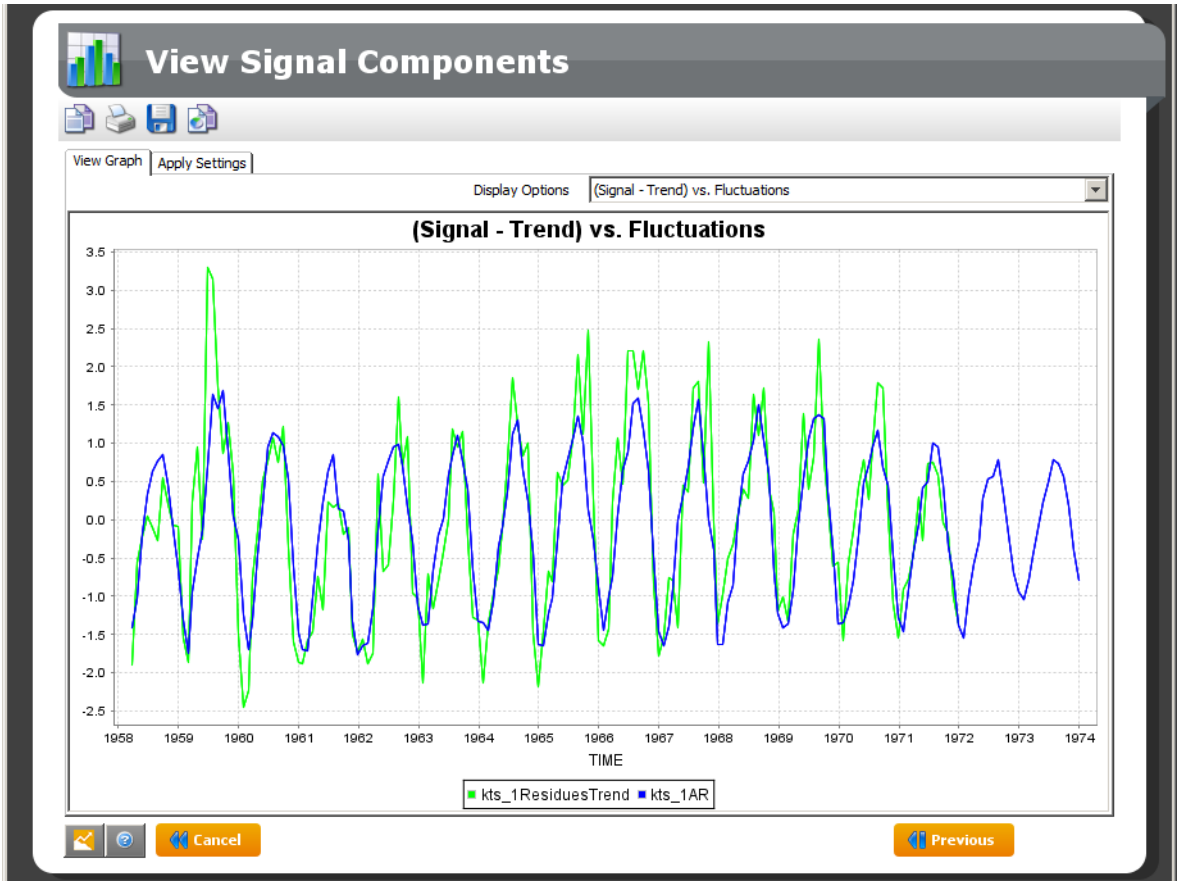
For this scenario

Time Series has detected fluctuations that are represented in blue in the plot *(Signal-Trend) vs. Fluctuation*.

> **Note**
>
> You can see that the trend has been removed from the signal to allow better visualization of the fluctuations.



A detailed explanation of the fluctuation can be found in section **Understanding the Model Debriefing > Signal Components > The Fluctuation** (see "**The Fluctuation**" on page 34).

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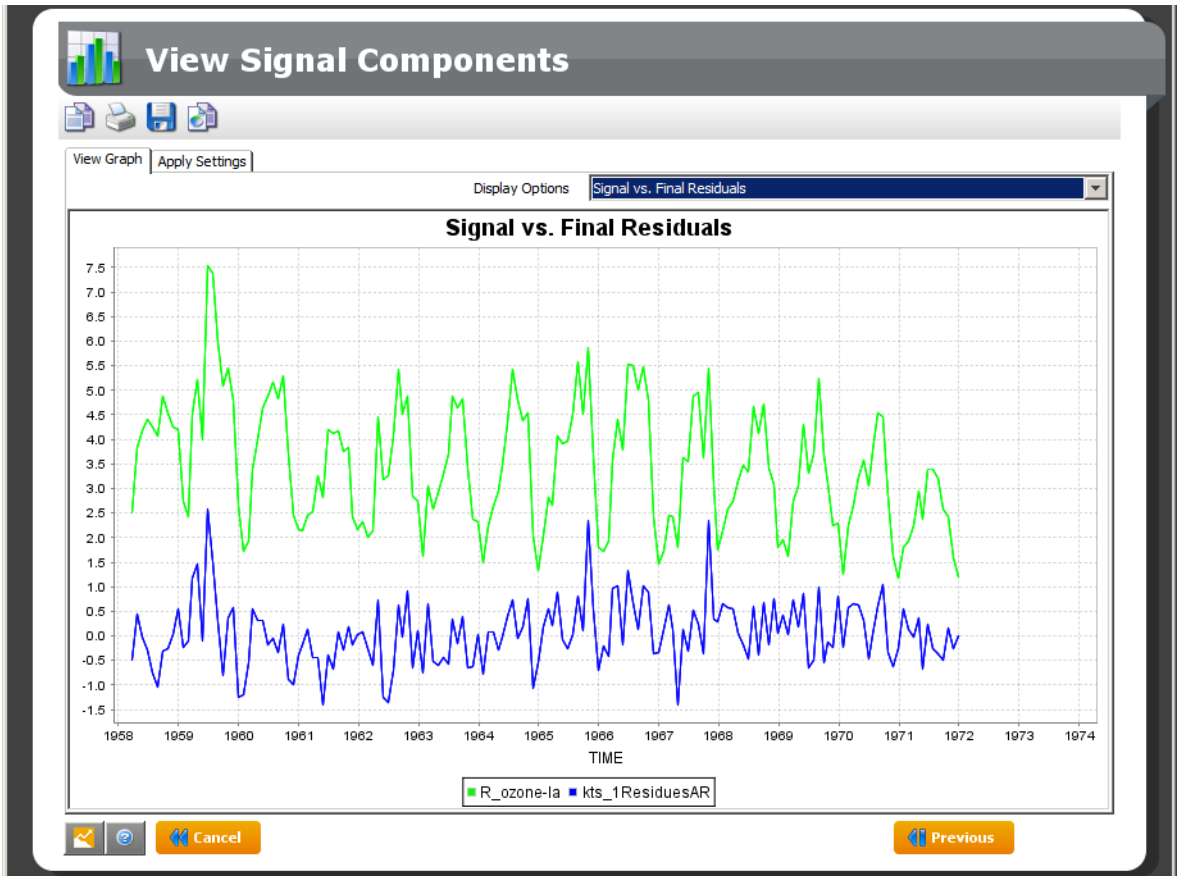
For this Scenario

The residuals found by the model appear in blue on the plot *Signal vs. Final Residuals*.



A detailed explanation of the residuals can be found in section **Understanding the Model Debriefing > Signal Components > The Residuals** (see "**The Residuals**" on page 34).

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3.4.4 Regressions: Contribution by Variables

The *Contributions by Variables* plot allows you to examine the relative significance of each of the variables in the regressions used in the model. The variables and the target variable used in the regression depends on the component being modeled. Two components can be modeled using a regression: the trend and the fluctuation.

The following table details which generated variables and which target can be used for the regressions:

Modeled Component	Possible Target Variable	Variables Used for the Regression
Trend	▪ signal	functions of the date, that is Time, square(Time), sqrt(Time) and the extra predictable variables.
Fluctuation	▪ signal ▪ signal - trend ▪ signal - trend - cycles	lag variables on the target

The following four types of plots allow you to visualize contributions by variables :

- *Variable Contributions*
- *Variable Weights*
- *Smart Variable Contributions*
- *Maximum Smart Variable Contributions*

The plot...	Presents...
Variable Contributions	The **relative importance** of each variable in the built model
Variable Weights	The **weights** (in the final polynomial) of the normalized variables
Smart Variable Contributions	The variables **internal** contributions
Maximum Smart Variable Contributions	The variables internal contributions including only the **maximum of similar variables**. For example, only binned encoding of the continuous variable age will be displayed

☑ To Display the Variable Contributions

1. On the screen *Using the Model*, click the option *Regressions: Contributions by Variables*. The screen *Contributions by Variable* is displayed.
2. Select the type of plot you want to display in the drop-down list *Chart Type*. The plot *Maximum Smart Variables* is displayed by default.

> **Note**
>
> In case of a regression on one variable only, the plot *Maximum Smart Variables* is not available. Use the drop-down list *Chart Type* to select another plot.

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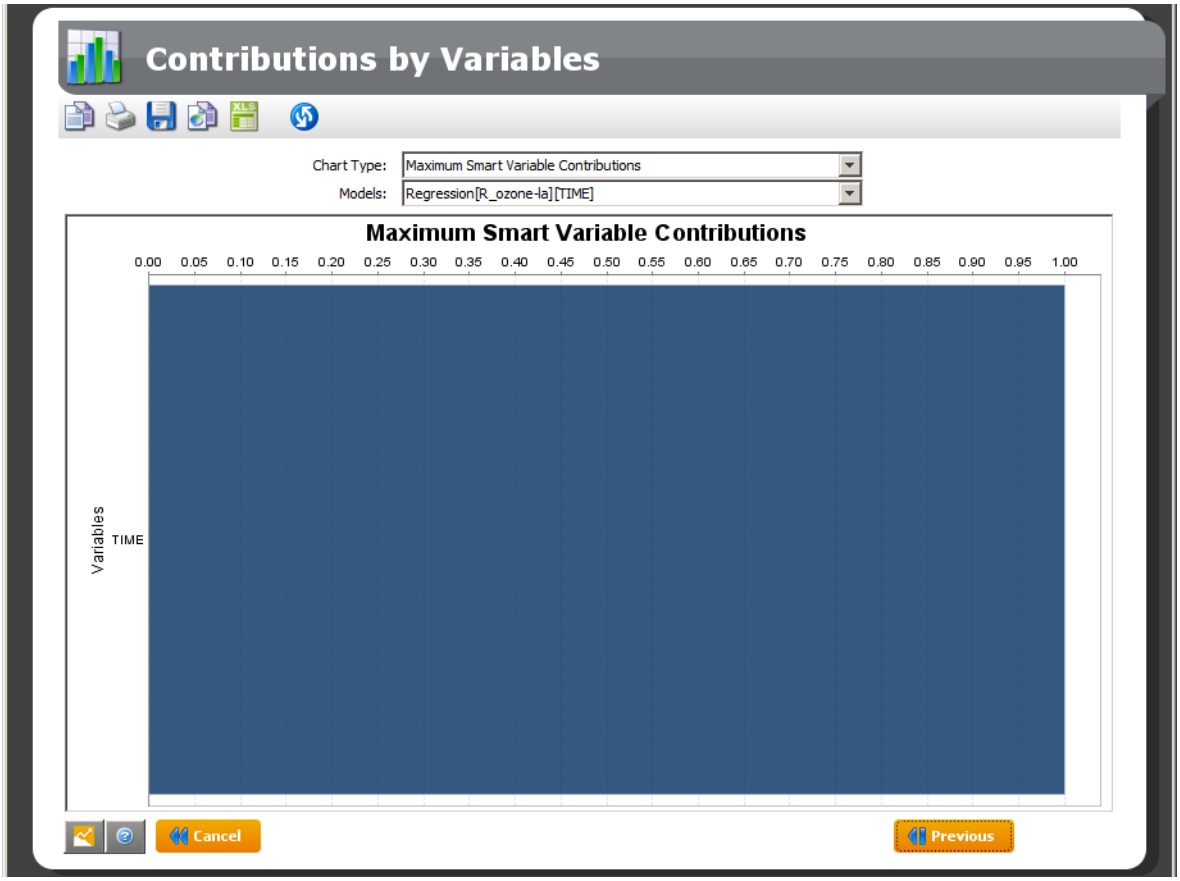

3 Select the regression you want to analyze in the *Models* drop-down list. Note that if there is only one regression in the model, the *Models* drop-down list is not displayed.

Understanding the Contributions by Variables

In this scenario, the model contains only the regression *linear(TIME)* which defines the trend.

3.4.5 Statistical Reports

To help you analyze your modeling results and to enable you to possibly share these results with your colleagues, managers, partners or customers, Time Series provides you with a set of statistical reports in various formats.

There are three categories of reports:

- the *Descriptive Statistics*, which provide information on the variables used to generate the model, such as the variables types and categories, the data set size, the cross-statistics...
- the *Performance Indicators*, which provide information on the performance of the model thanks to various indicators such as the forecasts error bars and efficiency, the U2, the standard deviation, ...
- the *Cyclic Variables*, which provide you with an analysis of the seasonal and cyclic variables displayed as graphs.

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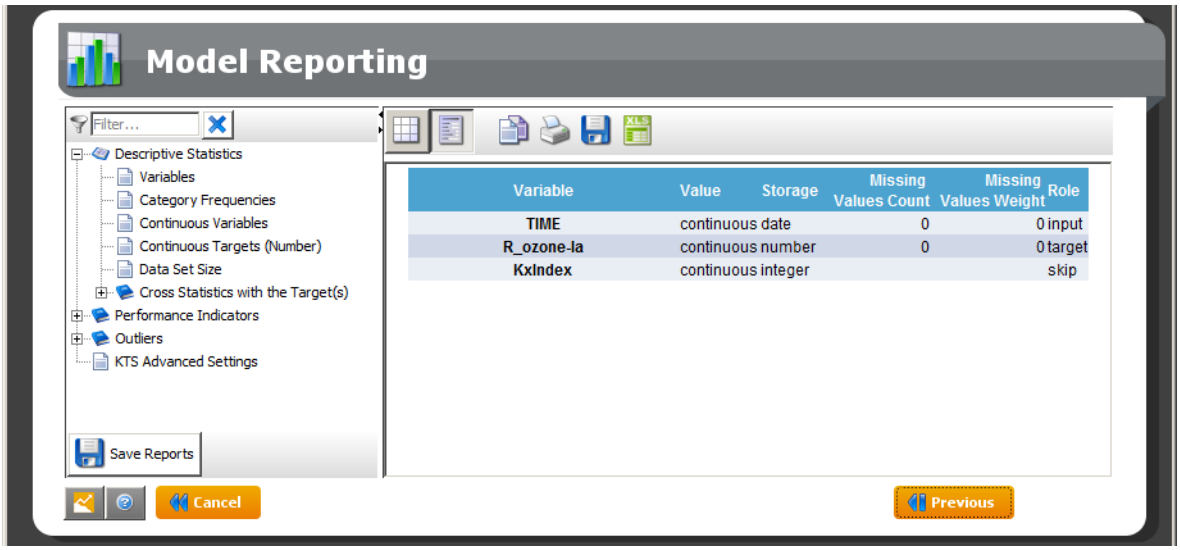
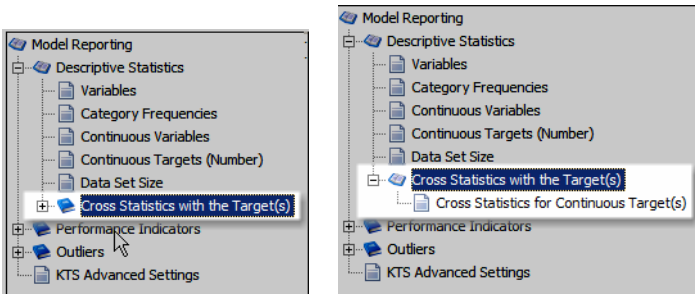
☑ To Display the Statistical Reports

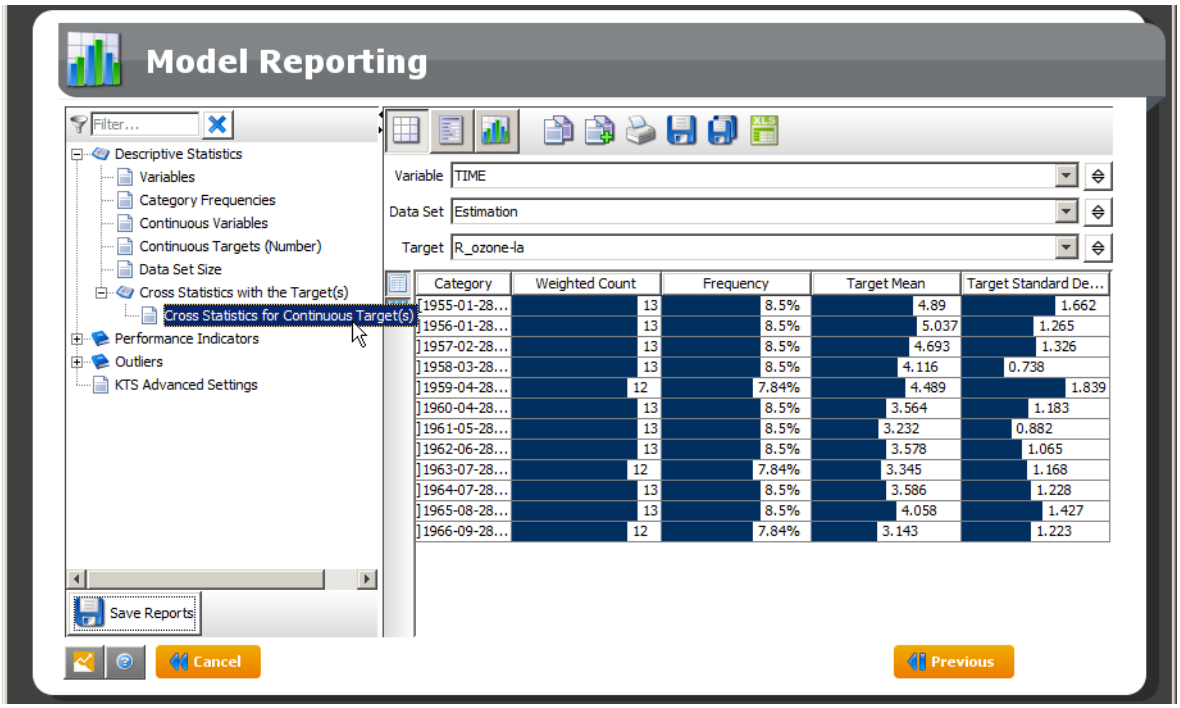
1 On the screen *Using the Model*, click the option *Statistical Reports*.
The screen *Model Reporting* is displayed.



2 Click the + displayed in front of a category of reports to display the available reports.



3 Double-click the desired report to display it in the right frame.



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Statistical Reports Options

A tool bar is provided allowing you to modify how the current report is displayed, to copy the report, print it or save it.

Display Options

	This option allows you to display the current report view in the graphical table that can be sorted by column.
	This option allows you to display the current report view as a HTML table.
	Some reports can be displayed as a bar chart. This bar chart can be sorted by ascending or descending values, or by ascending or descending alphabetical order. You can also select which data should be displayed.
	Some reports can be displayed as a pie chart.
	When the current report is displayed as a bar chart, this option allows you to change the orientation of the bars (from horizontal to vertical and vice versa).

Usage Options

	This option allows you to copy the data from the current view of the displayed report. The data can then be pasted in a text editor, a spreadsheet, a word processing software.
	If the current report contains more than one view (for various variables, data sets, and so on), this option allows you to copy all the views of this report.
	If the current report is displayed as a graph, this option allows you to copy it as an image and paste it in a word processing software or a graphic application.
	This option allows you to print the current view of the selected report depending on the chosen display mode (HTML table, graph, ...)
	This option allows you to save under different formats (text, html, pdf, rtf) the data from the current view of the selected report.
	This option allows you to save under different formats (text, html, pdf, rtf) the data from all the views of the selected report.

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3.5 Step 4 - Using the Model

Once generated, the model may be:

- **applied to additional data sets**. The model thus allows you to perform predictions on these application data sets, by predicting the values of a target variable.
- **saved** for later use.

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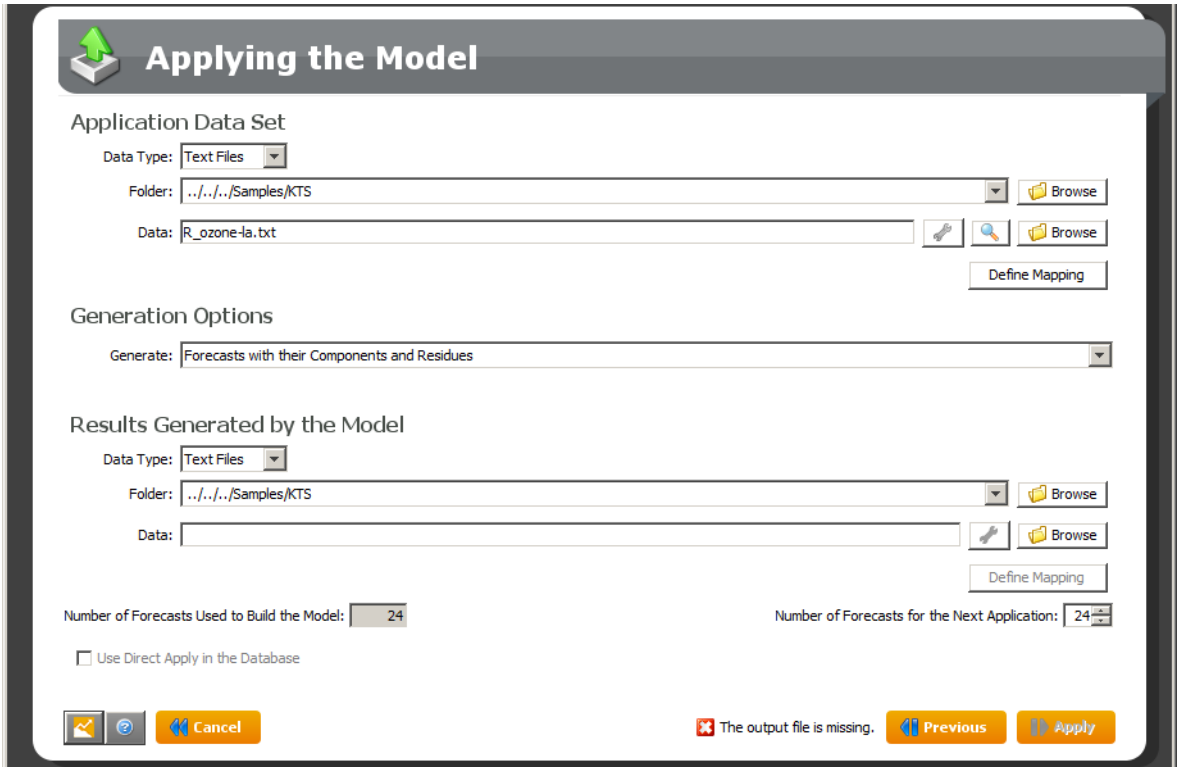
Applying the Model 49
Saving the Model 53
Opening a Model 54

3.5.1 Applying the Model

☑ To Apply the Model

1 On the screen *Using the Model*, click *Apply Model*.
The screen *Applying the Model* appears.



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2 In the section *Application Data Set*, the information concerning the data set is already filled.
See the section Application Data Set Requirements (on page 50) for further information.

3 In the section *Generation Options*, select the type of output you want (see section Type of Results Available (see "Understanding the Applying Mode" on page 51)).

4 Check the option *View Generated Outputs* to also display the apply results in the interface.

5 In the section *Results Generated by the Model*, select the file format for the output file (*Text files, Database*, *Flat Files*).

6 Click the *Browse* button to select:
- In the *Folder* field, the folder in which the result file will be saved,
- In the *Data* field, the name of the result file.

7 Click the *Apply* button.

8 Click the *Next* button.
The screen *Using the Model* appears.
Once application of the model has been completed, the results files of the application is automatically saved in the location that you had defined from the screen *Applying the Model*.

Application Data Set Requirements

The data set used to apply a Time Series model is generally the same used for training the model. Applying a Time Series model produces a similar output data set with extra columns and/or rows containing the requested forecasts.

It is also possible to apply a model to a different data set provided that the following conditions are fulfilled:

- the application data set must contain:
- the **target variable**
- all the **input variables** from the training data set (that is, all the variables that have not been excluded during the variables selection step)
- all the **key variables** from the training data set (except for the key variables automatically generated by SAP InfiniteInsight®, such as `KxIndex`)
- the **date column must be sorted** (strictly increasing, `Order Level = 1` for ODBC sources)
- the **first date of the application data set must be present in the time window defining the training data set**. For example, for the ozone model, a data set ozone without the first 10 rows is a valid application data set while a data set starting with the date value '1973-03-01' is not (since this date is not contained in the training data set, which ends on '1971-12-28').

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Type of Results Available

In the *Generate* pull-down menu you can choose to generate three types of results:

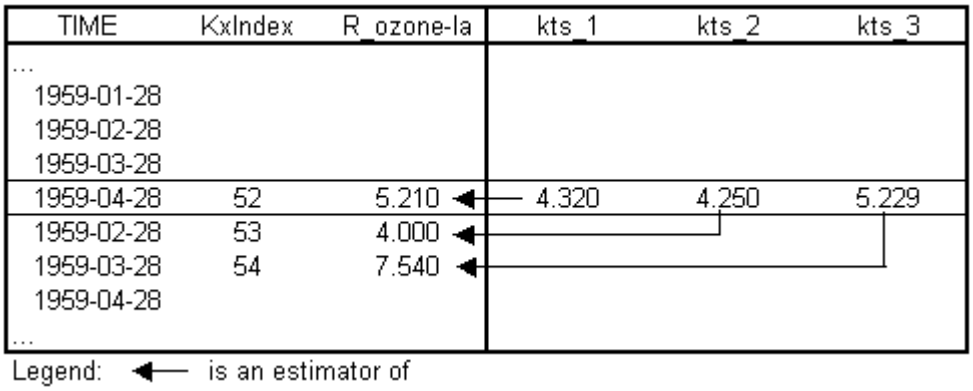
If you choose the option...	The result file will contain...
Predicted Values Only	▪ all input variables, ▪ the predicted variables, that is the forecasts for every date of the training data set.
Forecasts with their Components,	▪ all input variables, ▪ the predicted variables, that is the forecasts for every date of the training data set. ▪ the components value (trend, cycles, fluctuation) for each forecast
Forecasts with their Components and Residues	▪ all input variables, ▪ the predicted variables, that is the forecasts for every date of the training data set. ▪ the components value (trend, cycles, fluctuation) for each forecast ▪ the remaining values (residue) obtained after extracting each component from each forecast
Only First Forecasts Column and their Error Bars	▪ all input variables, ▪ the first predicted variable, that is the first forecast for every date of the training data set. ▪ the error bars for the predicted variable

Understanding the Applying Mode

A Time Series model can only be applied on all or part of the training data set.

The result file contains the input variables, that is the time and the signal, and as many predicted variables, noted *KTS_x*, as the number of forecasts requested.

The following table describes a Time Series result file, where *TIME* is the time variable and *R_ozone-la* is the signal variable.



- *KTS_1* is an estimator of the current value of the signal (at date *t*)
- *KTS_2* is an estimator for the next value of the signal (at date *t+1*)
- *KTS_3* is an estimator for the value of the signal at date *t+2*,
- and so on ...

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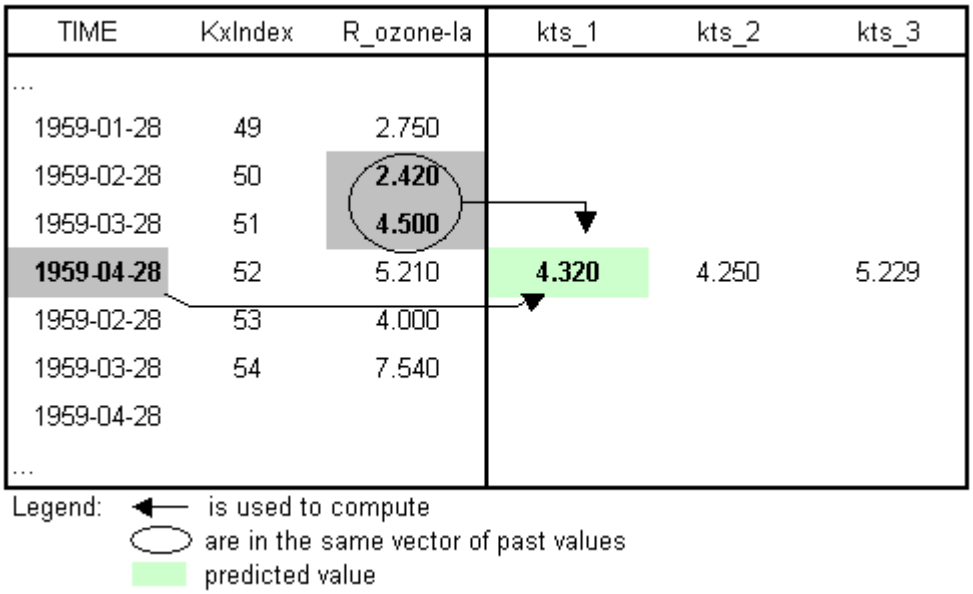
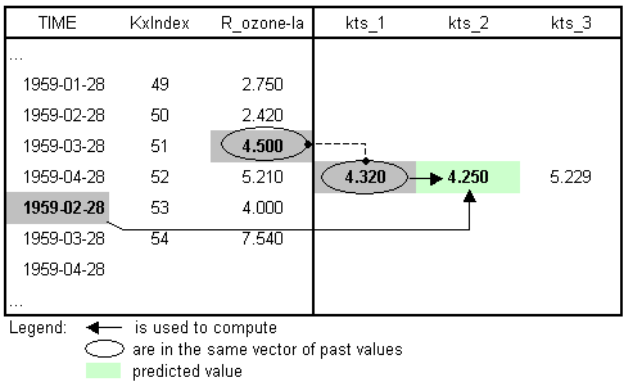
A Time Series model uses its own previous predictions to compute the next ones. The values used to compute a forecast are presented below.

- *KTS_1* is computed using the current date (known as *t*), the known extra predictable variables at this date, and past values of the signal:



- *KTS_2* is computed using date *t+1,* known values for extra predictable variables at this date, and past values of the signal. However since the signal value at date *t* is unknown, Time Series uses the last prediction, that is *KTS_1*, to compute *KTS_2*. The following table shows how KTS_2 is computed using KTS_1:



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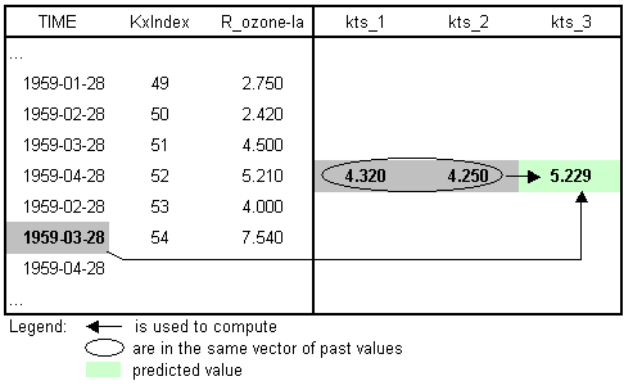
- *KTS_3* is computed using date *t+2,* known values for extra predictable variables at this date, and past values of the signal. However since the signal value at date *t* and *t+1* are unknown, Time Series uses the last two predictions, that is *KTS_1* and *KTS_2*, to compute *KTS_3*. The following table shows how KTS_3 is computed using KTS_1 and KTS_2:

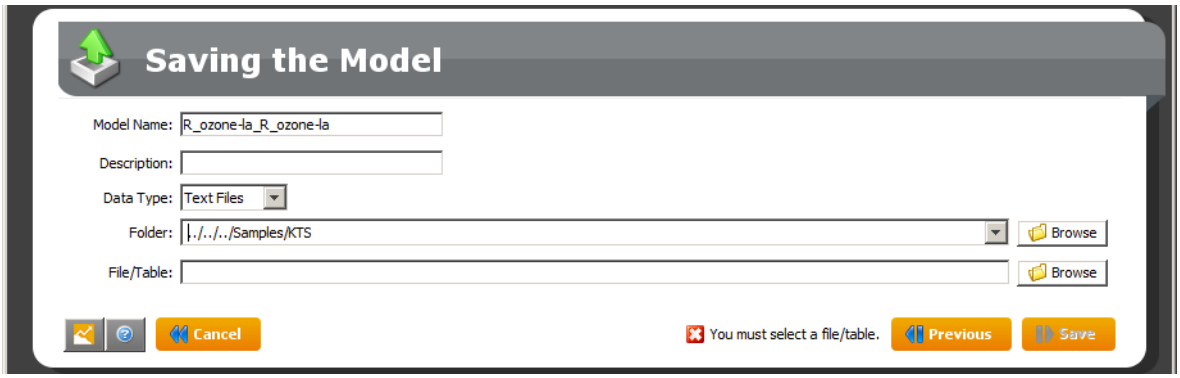


3.5.2 Saving the Model

Once a model has been generated, you can save it. Saving it preserves all the information that pertains to that model, that is, the modeling parameters, the forecasts view, and so on.

☑ To Save a Model

1 On the screen *Using the Model*, click *Save Model*.
The screen *Saving the Model* appears.



2 Above the *Browse* button, select one of the following options:
- *Text files*, to save the model in a text file.
- *Database*, to save the model in a database.
- *Flat Memory*, to save the model in the active memory.

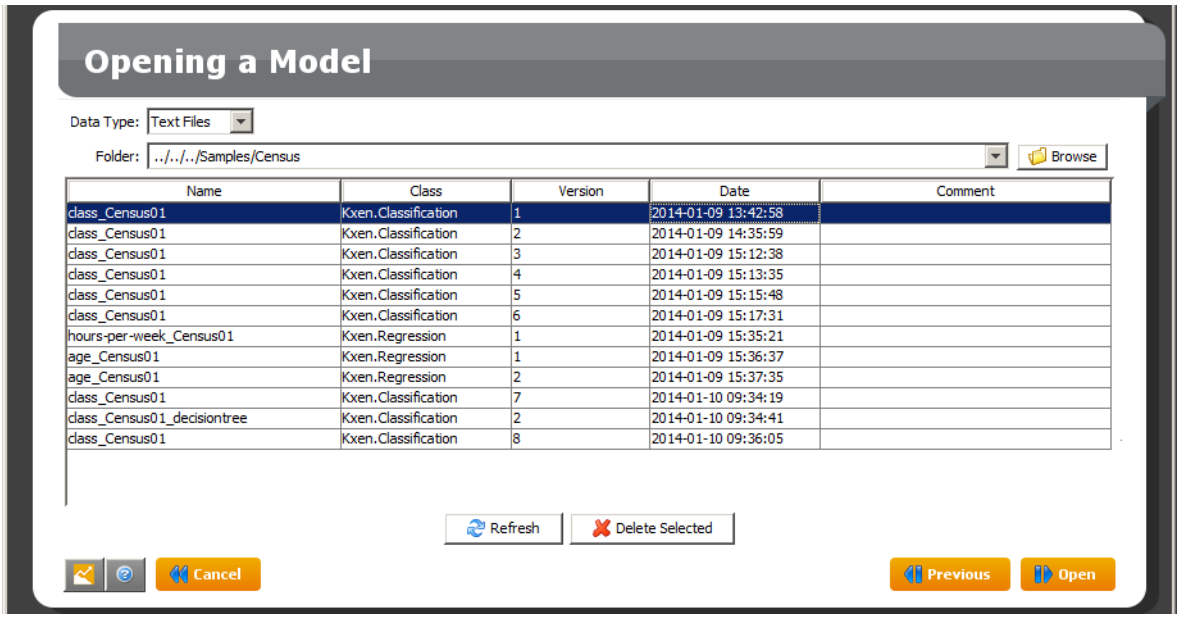
3 Complete the following fields:
- *Model Name:* This field allows you to associate a name with the model. This name will then appear in the list of models to be offered when you open an existing model.
- *Description*: This field allows you to enter the information of your choosing, such as the name of the training data set used or the number of forecasts calculated. This information will help you identify your model for a later use.
- *Folder:* Depending upon which option you selected, this field allows you to specify the ODBC source, the memory store or the folder in which you want to save the model.
- *File/Table*: This field allows you to enter the name of the file or table that is to contain the model. The name of the file must contain one of the following format extensions *.txt* (text file in which the data is separated by tabs) or *.csv* (text file in which the data is separated by commas).

3.5.3 Opening a Model

Once saved, models may be opened and reused in the SAP InfiniteInsight®.

☑ To Open a Model

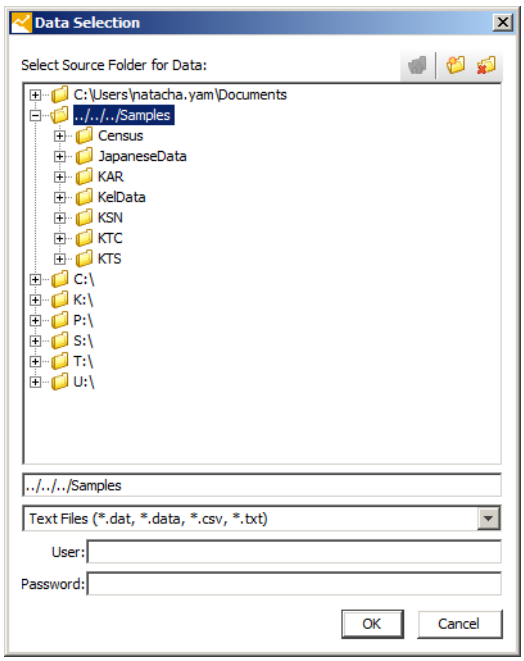
1 On the main screen of InfiniteInsight® modeling assistant, select *Load a Model*.
The screen *Opening a Model* appears.


Opening a Model
Data Type: Text Files
Folder: ../../../Samples/Census
Browse
Name | Class | Version | Date | Comment
class_Census01 | Kxen.Classification | 1 | 2014-01-09 13:42:58
class_Census01 | Kxen.Classification | 2 | 2014-01-09 14:35:59
class_Census01 | Kxen.Classification | 3 | 2014-01-09 15:12:38
class_Census01 | Kxen.Classification | 4 | 2014-01-09 15:13:35
class_Census01 | Kxen.Classification | 5 | 2014-01-09 15:15:48
class_Census01 | Kxen.Classification | 6 | 2014-01-09 15:17:31
hours-per-week_Census01 | Kxen.Regression | 1 | 2014-01-09 15:35:21
age_Census01 | Kxen.Regression | 1 | 2014-01-09 15:36:37
age_Census01 | Kxen.Regression | 2 | 2014-01-09 15:37:35
class_Census01 | Kxen.Classification | 7 | 2014-01-10 09:34:19
class_Census01_decisiontree | Kxen.Classification | 2 | 2014-01-10 09:34:41
class_Census01 | Kxen.Classification | 8 | 2014-01-10 09:36:05
Refresh
Delete Selected
Cancel
Previous
Open

2 Select one of the following *Data Type* options:
- *Text files*,
- *Database*,
- *Flat files*,

depending upon the format of the model that you want to open.

3 Click the *Browse* button.
A selection dialog box appears.



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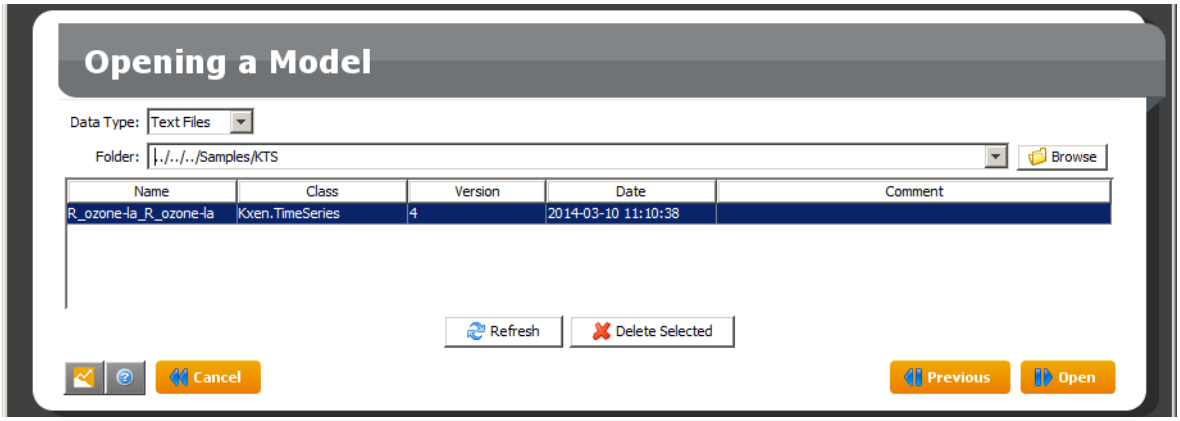
4 Select the folder that holds the model that you want to open.
The list of models contained in that folder appears.



The following table lists the information provided for each model allowing to identify the model you want to reload.

Column	Description	Values
Name	Name under which the model has been saved	Character string
Class	Class of the model, that is the type of the model	▪ `Kxen.Classification`: Classification/Regression with nominal target ▪ `Kxen.Regression`: Classification/Regression with continuous target ▪ `Kxen.Segmentation`: Clustering with SQL Mode ▪ `Kxen.Clustering`: Clustering without SQL Mode ▪ `Kxen.TimeSeries`: Time Series ▪ `Kxen.AssociationRules`: Association Rules ▪ `Kxen.SimpleModel`: Classification/Regression and Clustering multi-target models, any other model
Version	Number of the model version when the model has been saved several times	Integer starting at 1
Date	Date when the model has been saved	Date and time in the format `yyyy-mm-dd hh:mm:ss`
Comment	Optional user defined comment that can be used to identify the model	Character string

5 Select a model from the list.

6 Click the *Open* button.
The *Using the Model* menu appears.

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4 Scenario 2: Modeling with Extra Predictable Variables

This section details:

- what are the extra inputs variables for Time Series,
- how to use these extra variables,
- what is the impact of this feature on the modeling.

IN THIS CHAPTER

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Comparing the Forecasts With and Without Extra Predictable Variables 65

4.1 Presentation

In Forecasting modeling, extra variables are exogenous factors that may have an influence on the modeling. These variables can be ordinal, binary or continuous. Time Series makes a distinction between two categories of extra variables: the predictable and the unpredictable inputs.

The Predictable variables are variables which future values are known (like the first Friday of the month, the first working day of the month, and so on). This type of variable can contain additional information, which can be very useful for the trend and/or the cyclic analysis.

The predictable variable is the subject of this section.

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4.2 Standard Modeling

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Selecting a Data Source and a Cutting Strategy 57
Describing the Data 58
Selecting Variables 58
Defining the Forecasts Number 58
Viewing the Generated Forecasts 59

4.2.1 Summary of the Modeling Settings to Use

In this step, you will follow the default scenario without using any extras predictable variables (see section **Standard Modeling with** *InfiniteInsight® Modeler – Time Series* (on page 11)).

The table below summarizes the modeling settings that you must use. It should be sufficient enough for users who are already familiar with the KJWizard.

For detailed procedures and more information, see the following sections.

Replace the options given in the scenario by the following ones:

Task(s)	Screen	Settings
• Specifying the data source • Selecting a cutting strategy	*Data to be Modeled*	• In the field *Data Set*, select the file *CashFlows.txt* • *Cutting strategy*: sequential without test
Specifying a description file	*Data Description*	• In the field *Description*, select the file *KxDesc_CashFlows.txt*
Defining the extra predictable inputs number	*Selecting Variables*	• Select and exclude all the variables from the field *Predictable Variables Kept*
Defining the Forecasts Number	*Summary of Modeling Parameters*	• In the field *Number of Forecasts*, enter *20*

4.2.2 Selecting a Data Source and a Cutting Strategy

For this Scenario

- Use the file *CashFlows.txt* as the training data set.
- Select the cutting strategy *Sequential without test*.

For the detailed procedures, refer to sections 3.2.1 Selecting a Data Source (on page 13) and 3.2.2 Selecting a Cutting Strategy (on page 14).

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4.2.3 Describing the Data

For this Scenario

Use the description file *KxDesc_CashFlows.txt*.

For the detailed procedure, refer to section 3.2.3 Describing the Data Selected (on page 15).

4.2.4 Selecting Variables

For this Scenario

- Keep *Date* as the time variable.
- Keep *Cash* as the target variable.
- Exclude all extra predictable variables.
- Do not select a weight variable.
- Check that the last training line is set at *251*.

On the screen displaying the signal:

- Select the option *Date* in the *Time* list.

For detailed procedures, refer to section 3.2.4 Selecting Variables (on page 17)

4.2.5 Defining the Forecasts Number

For this Scenario

- Define the number of forecasts to *21*. This number corresponds to the average number of days worked in one month.

For the detailed procedure, refer to section Defining the Number of Forecasts (on page 20).

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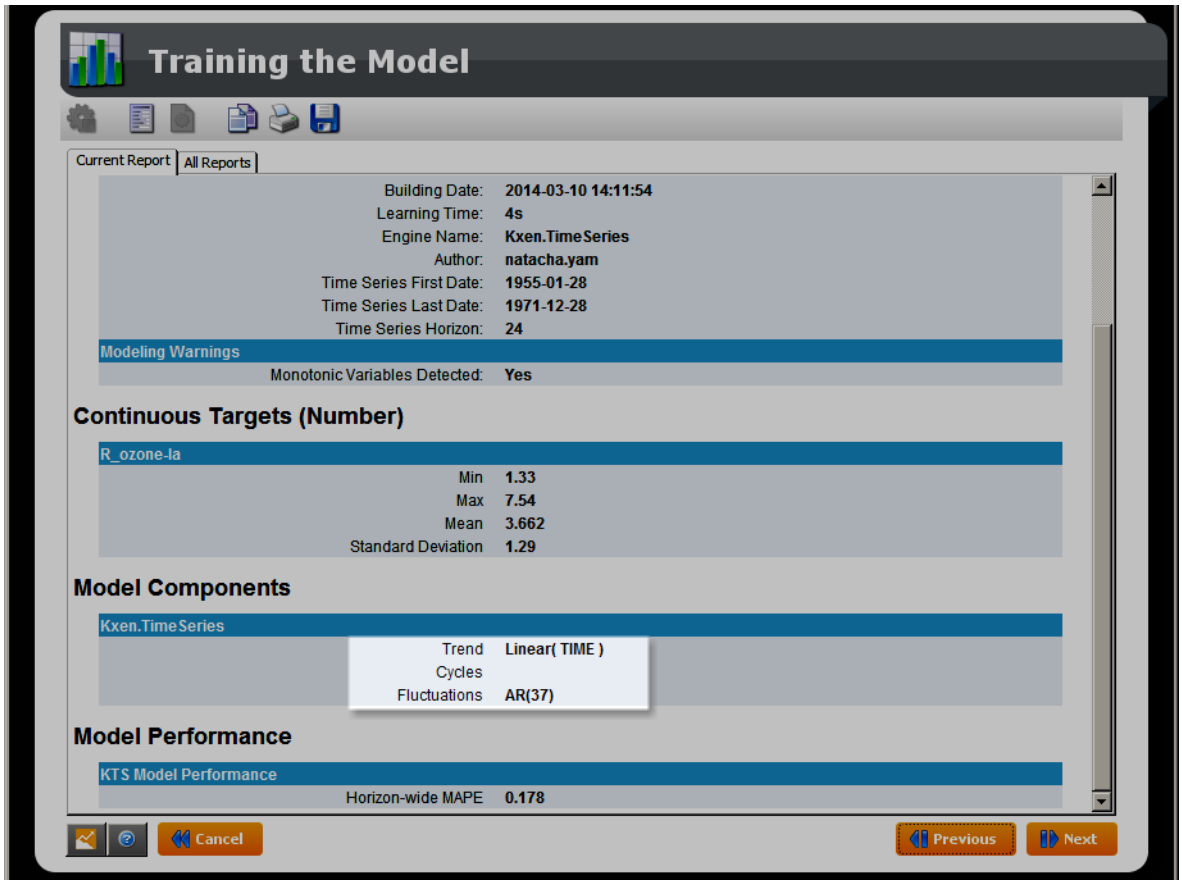
4.2.6 Viewing the Generated Forecasts

For this Scenario

The model obtained has the following form: *Model = AR(37) + polynom(Date) + R*.



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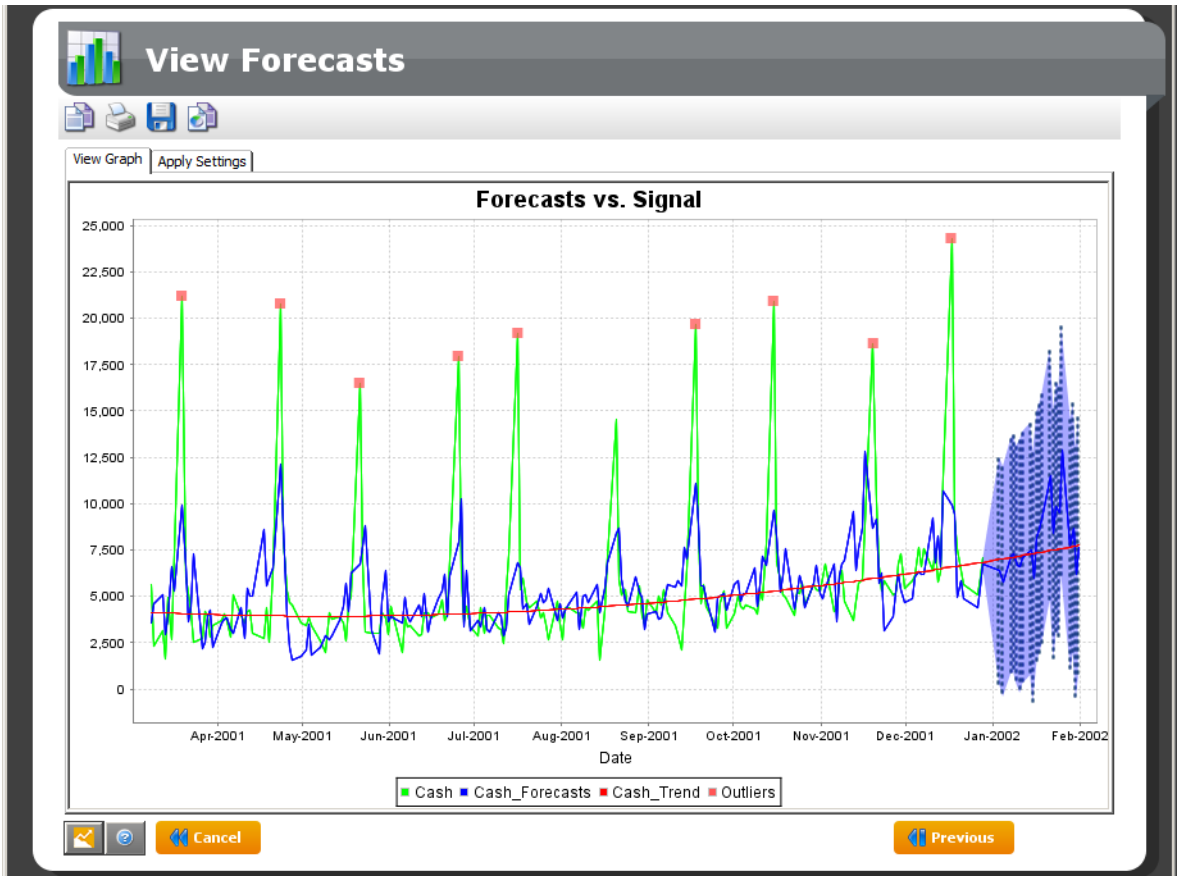
☑ To View the Corresponding Forecasts

1 On the menu *Using a Model*, click the option *View Forecasts*.

2 Click the *Next* button, the screen *View Forecasts* appears.



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4.3 Modeling with Extra Predictable Inputs

The following section will show how extra predictable variables can increase the performances on the current data set.

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Summary of the Modeling Settings to Use 61
Selecting a Cutting Strategy and a Data Source 61
Describing the Data 62
Selecting Variables 62
Defining the Forecasts Number 62
Viewing the Generated Forecasts 63

4.3.1 Summary of the Modeling Settings to Use

In this step, you will execute Scenario 2 using extra predictable variables. The table below summarizes the modeling settings that you must use. It should be sufficient enough for users who are already familiar with the InfiniteInsight® modeling assistant.

For detailed procedures and more information, see the following sections.

Replace the options given in the scenario by the following ones:

Task(s)	Screen	Settings
▪ Specifying the data source ▪ Selecting a cutting strategy	*Data to be Modeled*	▪ In the field *Data Set*, select the file *CashFlows.txt* ▪ *Cutting strategy*: sequential without test
Specifying a description file	*Data Description*	• In the field *Description*, select the file *KxDesc_CashFlows.txt*
Defining the extra predictable inputs	*Selecting Variables*	• Keep all the variables in the field *Predictable Variables Kept*
Defining the Forecasts Number	*Summary of Modeling Parameters*	• In the field *Number of Forecasts*, enter *21*

4.3.2 Selecting a Cutting Strategy and a Data Source

For this Scenario

- Use the file *CashFlows.txt* as the training data set.
- Select the cutting strategy *Sequential without test*.

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For the detailed procedures, refer to sections 3.2.1 Selecting a Data Source (on page 13) and 3.2.2 Selecting a Cutting Strategy (on page 14).

4.3.3 Describing the Data

For this Scenario

Use the description file *KxDesc_CashFlows.txt*.

For the detailed procedure, refer to section 3.2.3 Describing the Data Selected (on page 15).

4.3.4 Selecting Variables

The panel *Selecting Variables* allows you to:

- select the time variable,
- select the target variable,
- select a weight variable (optional),
- set the last date to use for training the model,
- select which variables should be kept for the modeling.

For this Scenario

- Keep *Date* as the time variable.
- Keep *Cash* as the target variable.
- **Keep all** the **extra predictable variables**.
- Do not select a weight variable.
- Check that the last training line is set at *251*.

On the screen *Displaying the Signal*:

- Select the option *Date* in the *Time* list.

For the detailed procedures, refer to section 3.2.4 Selecting Variables (on page 17)

4.3.5 Defining the Forecasts Number

For this Scenario

- Define the number of forecasts to *21*. This number corresponds to the average number of days worked in one month.

For the detailed procedure, refer to section Defining the Number of Forecasts (on page 20).

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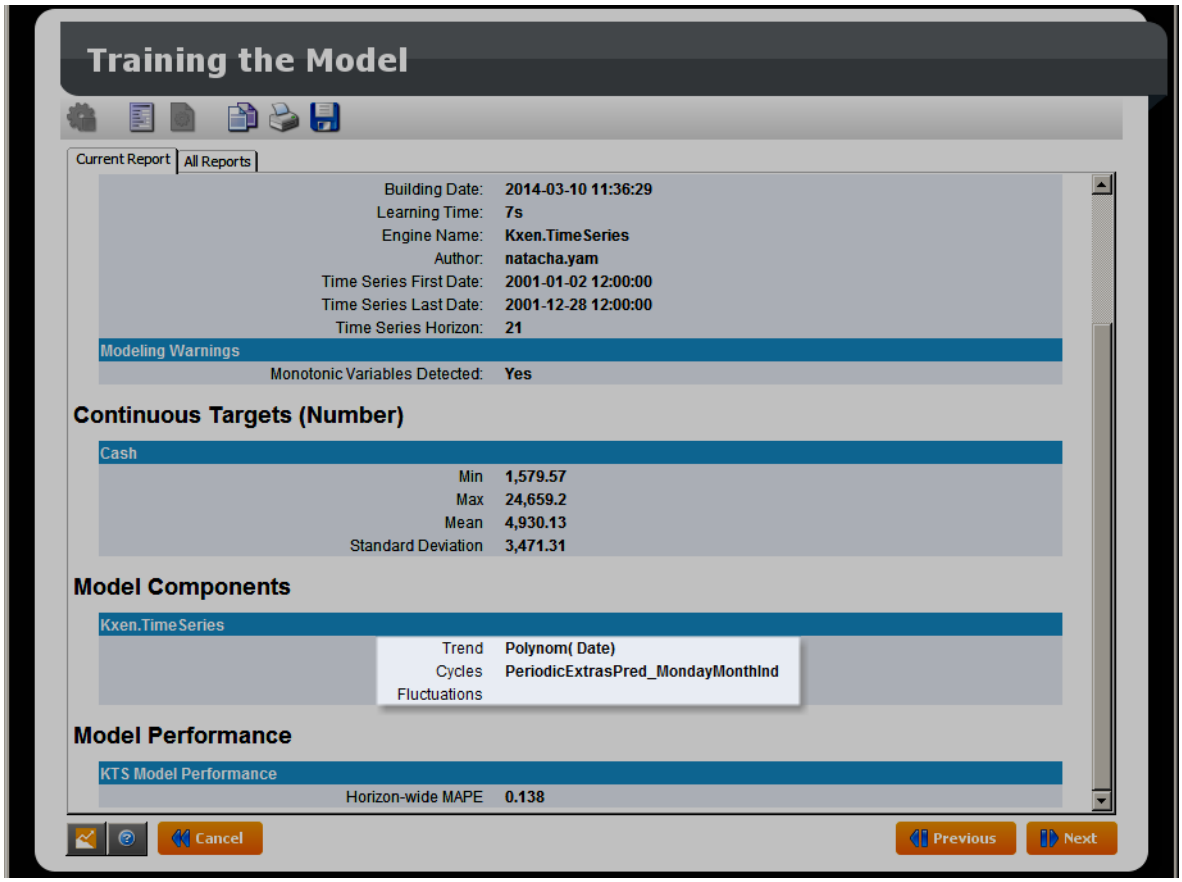
4.3.6 Viewing the Generated Forecasts

For this Scenario

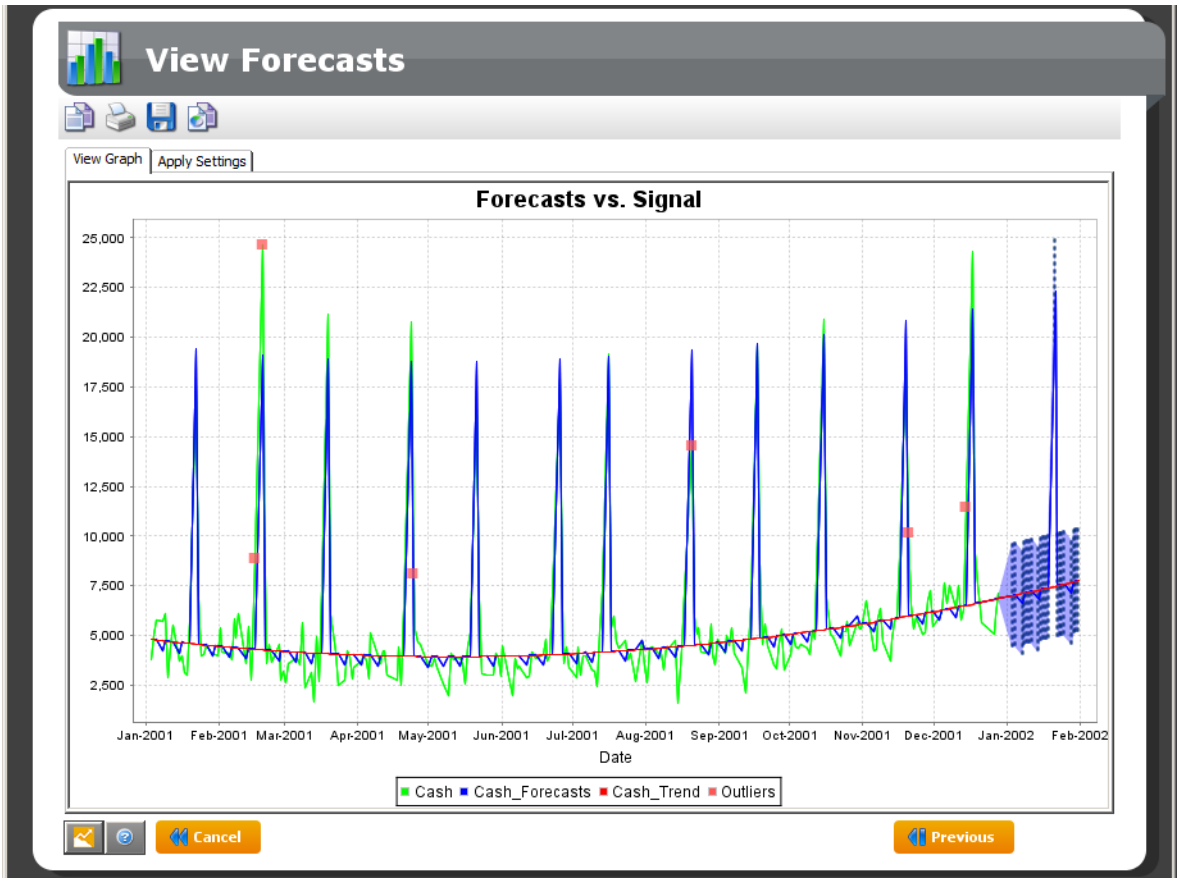
You get a model which have the following form:
Model = Polynom(Date) + Cyclic(PeriodicExtrasPred_MondayMonthInd) + R



☑ To View the Corresponding Forecasts

1 On the menu *Using a Model*, click the option *View Forecasts*.

2 Click the *Next* Button, the screen *View Forecasts* appears.



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4.4 Comparing the Forecasts With and Without Extra Predictable Variables

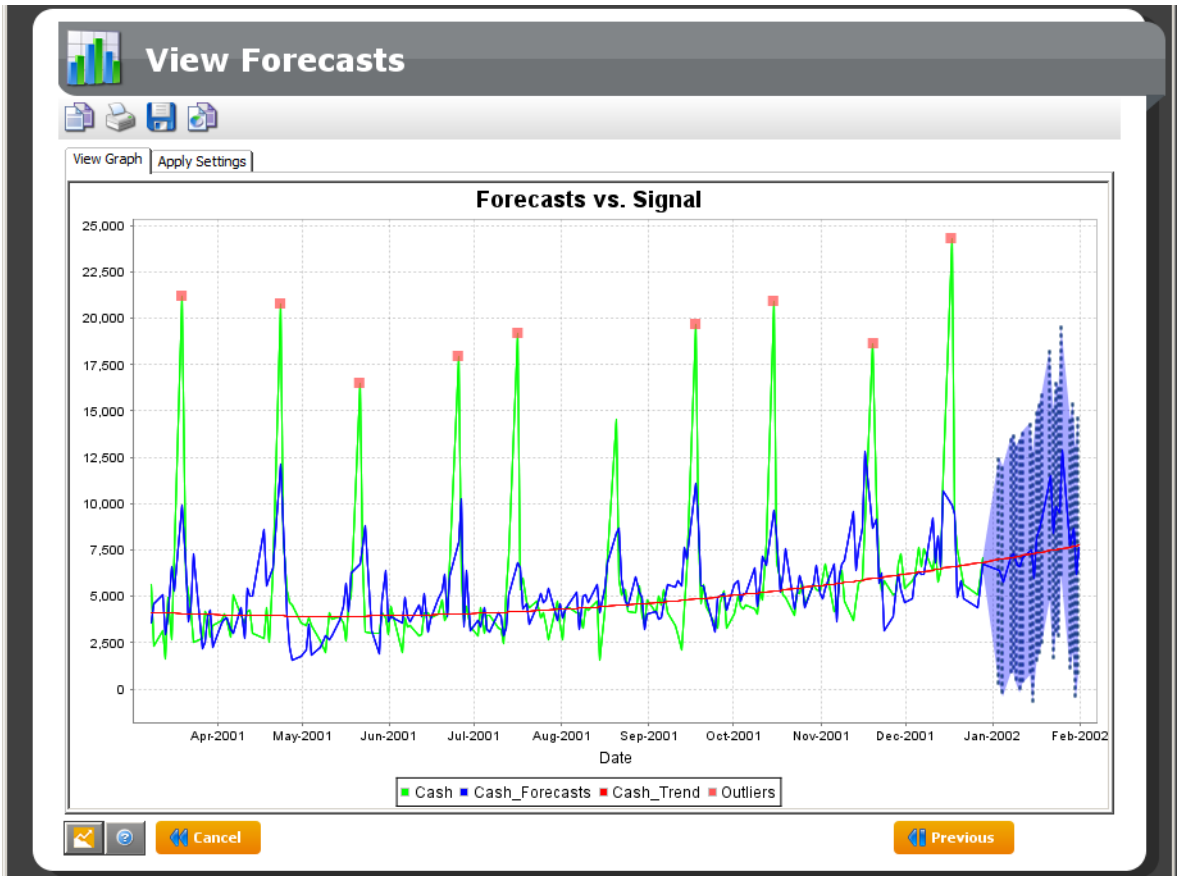
To better understand how extra predictable variables can improve a model, this section will analyze and compare the forecasts obtained with both a standard modeling and a modeling with extra predictable variables.

IN THIS CHAPTER

Understanding Forecasts without Extra Predictable Variables 65
Understanding Forecasts with Extra Predictable Variables 66

4.4.1 Understanding Forecasts without Extra Predictable Variables

The following screen displays the forecasts generated by Time Series when the extra predictable variables have been excluded.



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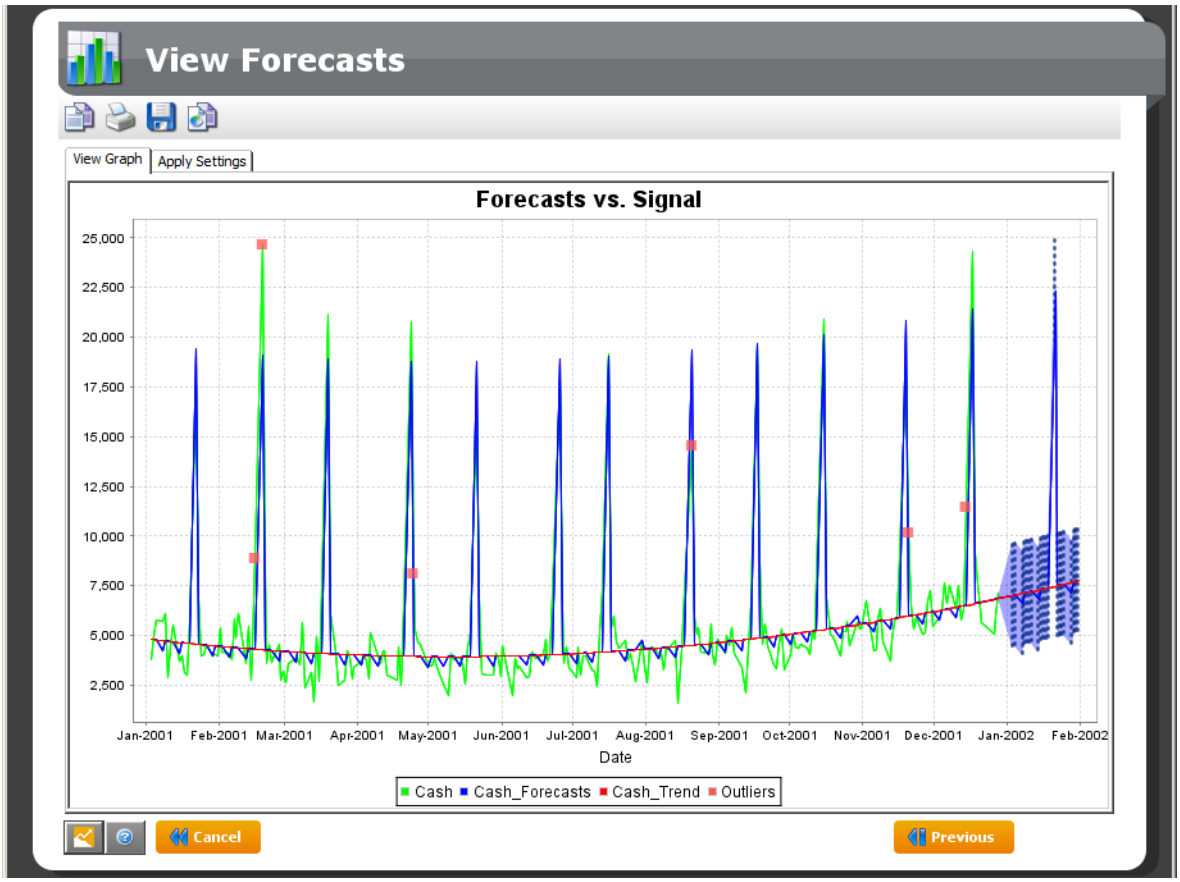
In this model, the engine uses its own variables (cyclics, trend, fluctuations,...) to generate the more predictive model possible. The trend and the picks position are correctly detected but the following points could be improved:

- the error bars are very extended, meaning that the confidence of the model is low,
- the picks amplitude is not correctly forecasted,
- the model appears noisy.

The solution to refine this model is to add extra predictable variables.

4.4.2 Understanding Forecasts with Extra Predictable Variables

The following screen displays the forecasts generated by Time Series when using extra predictable variables.



In this scenario, the addition of extra predictable variables has improved the trend detection and therefore the model quality. The three points that needed to be refined in the previous section are improved:

- the error bars are reduced, especially for the forecasted pick,
- the picks amplitude is correctly forecasted,
- the noise has been almost completely attenuated.

The extra predictable variable selected by the *InfiniteInsight® Modeler – Time Series* engine to refine the model is the monday in month index. It is found in the model definition: Cyclic(PeriodicExtrasPred_MondayMonthInd) + polynom(Date) + R.

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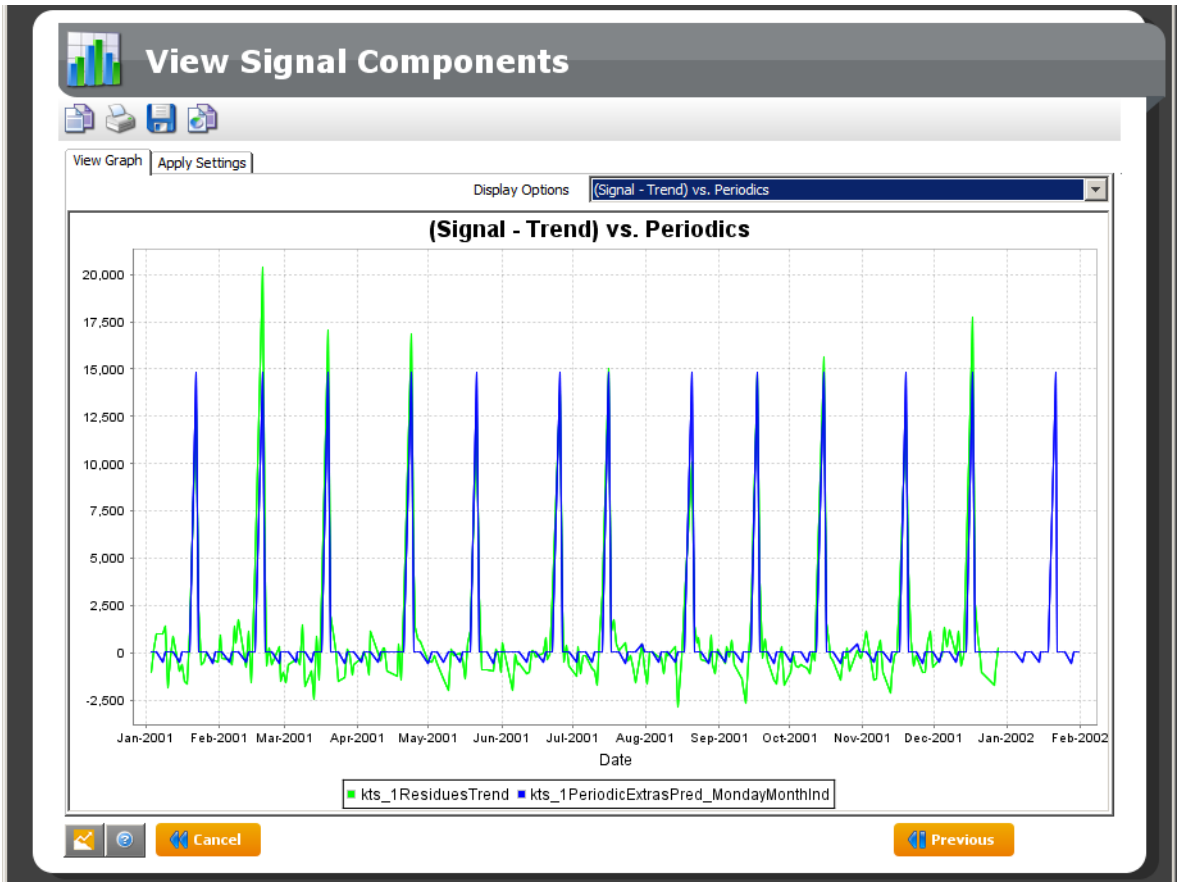
☑ To Display the Periodics

1 On the *Using the Model*, select the option *View Signal Components*.

2 In the list *Display Options*, select the option *(Signal-Trend) vs Periodics*. The following screen appears.



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Modeling using KxShell scripts

This section details the KxShell script corresponding to Scenario 2.

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Setting the PredictableExtras parameter 71
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Applying the model 73

Creating the time series model

The following code describes the method to create a **Forecasting** model. A default model is created including a Forecasting transform.

For this scenario

```
#creating a model with a Forecasting transform
createModel Kxen.SimpleModel model
model.pushTransformInProtocol Default Kxen.TimeSeries
```

Setting the model parameters

The cutting strategy is the only one model parameter, which has to be set.

For this scenario

```
#setting the model's parameters
model.getParameter ""
model.changeParameter "Parameters/CutTrainingPolicy" "sequential with no test"
model.validateParameter
```


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Opening the Training Data Set

In this step, the training data set **CashFlows.txt** is opened with its description **KxDesc_CashFlows.txt**. As the file contains training information and predictive information, the line index of the end of training is fixed.

For this scenario

```
#open the training data set
model.openNewStore Kxen.FileStore .
model.newDataSet Training CashFlows.txt
model.readSpaceDescription Training KxDesc_CashFlows.txt

#set the line index of the end of training
bind model DataSet Training myDataset
myDataset.getParameter ""
myDataset.changeParameter "Parameters/LastRow" 251
myDataset.validateParameter
delete myDataset
```

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Setting the time series transform parameter

The **Forecasting** transform parameters are the following:

- **AutoFeedCount** saves the number of forecasts asked by the user (default = 1).
- **MaxCyclics** indicates the maximum number of cyclicalities, that will be analyzed by Time Series (default = 450).
- **DateColumnName** saves the name of the date variable (required parameter).
- **ForecastsConnection** gives the format of the forecasts in the output of Time Series (default = 1). If its value is 1, then the forecasts will be transposed at the end of the KTS_1 variable with the corresponding dates. If its value is 0, then the forecasts stay in the last line of the file.
- **LastRowWithForecastingInformation** saves the index of the last line of the file. This parameter is required if you want to use extras predictable inputs.
- **PredictableExtras** saves the names of the extras predictable variable.
- **UnPredictableExtras** saves the names of the extras unpredictable variables. This parameter is not activated today.
- **ExtraMode**, gives the the format of the output of Time Series (default = No Extra). "**No Extra**" value is the default format with the KTS_ variables. "**Signal Components**" value is the format which includes with the previous cited variables, each component of each variables: trend, cycles/seasonality, fluctuations. "**Component Residues**" value is the format, which includes with the previous format the residues after each variable component.

For this scenario

```
#setting KTS basic parameters
bind model TransformInProtocol Default 0 myKTS
myKTS.getParameter ""
myKTS.changeParameter "Parameters/DateColumnName" Date
myKTS.changeParameter "Parameters/AutoFeedCount" 20
myKTS.changeParameter "Parameters/LastRowWithForecastingInformation" 271
myKTS.validateParameter
```


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Setting the PredictableExtras parameter

All the variables, except *Date* and *FlowsEmitted*, are added to the PredictableExtras parameter.

For this scenario

```
#setting KTS PredictableExtras parameter
myKTS.bindParameter "Parameters/PredictableExtras" extra1
extra1.insert ReverseWorkingDaysIndices dummyPar_1
extra1.insert MondayMonthInd dummyPar_2
extra1.insert TuesdayMonthInd dummyPar_3
extra1.insert WednesdayMonthInd dummyPar_4
extra1.insert ThursdayMonthInd dummyPar_5
extra1.insert FridayMonthInd dummyPar_6
extra1.insert BeforeLastMonday dummyPar_7
extra1.insert LastMonday dummyPar_8
extra1.insert BeforeLastTuesday dummyPar_9
extra1.insert LastTuesday dummyPar_10
extra1.insert BeforeLastWednesday dummyPar_11
extra1.insert LastWednesday dummyPar_12
extra1.insert BeforeLastThursday dummyPar_13
extra1.insert LastThursday dummyPar_14
extra1.insert BeforeLastFriday dummyPar_15
extra1.insert LastFriday dummyPar_16
extra1.insert Last5WDaysInd dummyPar_17
extra1.insert Last5WDays dummyPar_18
extra1.insert Last4WDaysInd ummyPar_19
extra1.insert Last4WDays dummyPar_20
extra1.insert LastWMonth dummyPar_21
extra1.insert BeforeLastWMonth dummyPar_22
delete extra1
myKTS.validateParameter
```

Learning the model

Once all the parameters have been set, the learning phase is launched.

For this scenario

```
#learning the model
model.sendMode learn
```

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Saving the model

Once a model has been generated, you can save it. Saving it preserves all the information that pertains to that model, that is, the modeling parameters, its profit curves, and so on. Note that the directory in which the model is saved must exist.

For this scenario

```
#saving the model in the current directory

model.saveModel DefaultBankFlows_Model.txt "With Extras Predictable Inputs and 20 forecasts"
```

Opening an Existing Model

Once saved, models may be opened and reused in SAP InfiniteInsight®.

For this scenario

```
createStore Kxen.FileStore myRestoreStore

myRestoreStore.openStore .

setDefaultUserPassword "" ""

myRestoreStore.restoreLastModelD model
```


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Applying the model

A model generated by Time Series can be applied ONLY to data sets for which the first date of the "time" variable is located between the first date and the last date of the "time" variable of the training data set. By default, a model generated by Time Series is applied to the training data set

To apply the model, you have to open a data set containing the data to use: the **ApplyIn** data set. You have to open as well a data set, that will contain the output of the apply session: the **ApplyOut** data set.

As the training data set specifications, you have to set the end of the training section, i.e. the end of the known values of the signal.

By default, the model is applied with the same horizon as the horizon used for training. The user can however apply with a different horizon by setting the parameter **AutoFeedCountApplied**.

For this scenario

```
#Applying the model on the training data set: default use.
#open the ApplyIn data set
model.newDataSet ApplyIn CashFlows.txt
bind model DataSet ApplyIn myDataset
myDataset.getParameter ""
myDataset.changeParameter "Parameters/LastRow" 251
myDataset.validateParameter
delete myDataset

#open the ApplyOut data set
model.newDataSet ApplyOut out_CashFlows.txt

#apply the model
model.sendMode apply
#open the ApplyOut data set
model.openNewStore Kxen.FileStore "Saved"
model.newDataSet ApplyOut out_CashFlows.txt

#apply the model
model.sendMode apply

# apply with a different horizon (=6)
bind model TransformInProtocol Default 0 myKTS
myKTS.getParameter ""
myKTS.changeParameter "Parameters/AutoFeedCountApplied" 6
myKTS.validateParameter
model.sendMode apply
```

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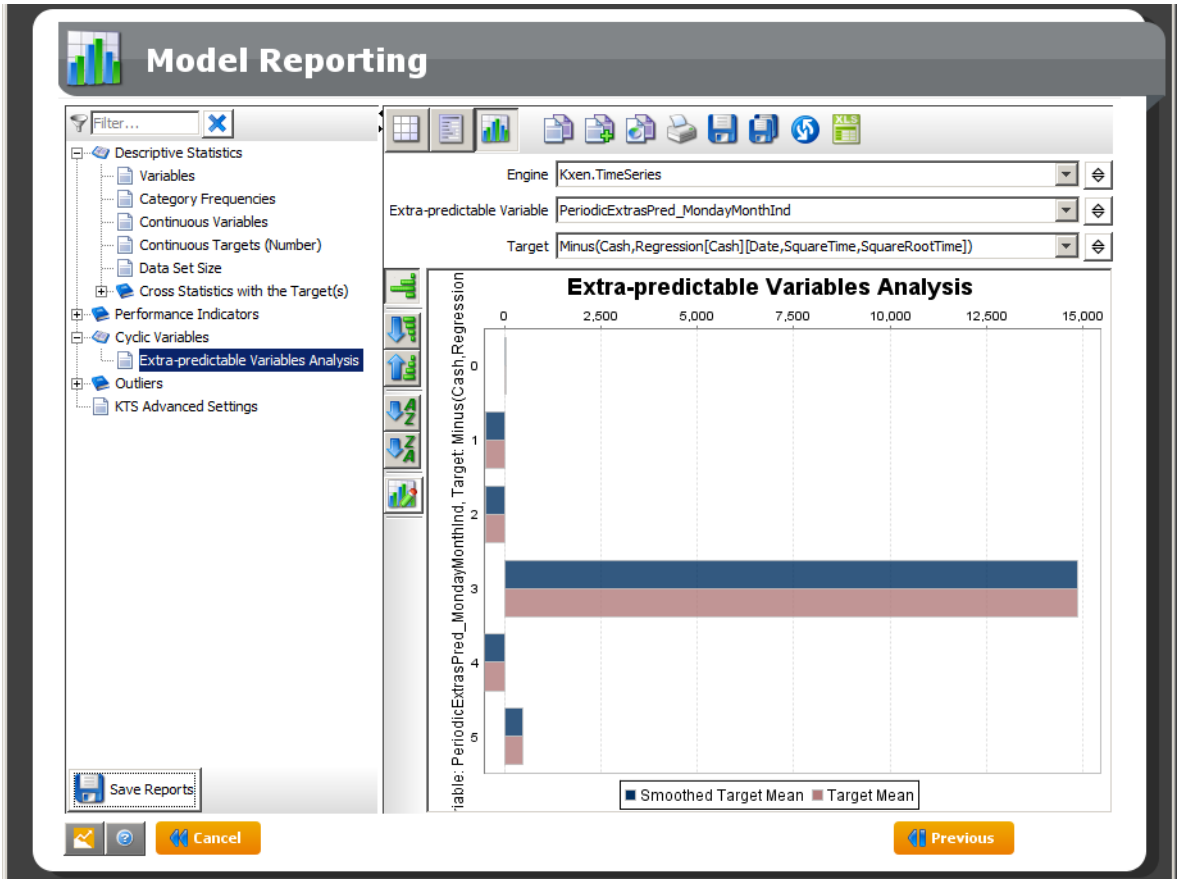
☑ To Display Cyclic Details

1 On the panel *Using the Model*, select the option *Statistical Reports*.

2 On the left menu, select the item *Cyclic Variables* > *Extra Predictable Variables Analysis*. The following screen appears.



Understanding Cyclic Details

This screen presents the cyclic *PeriodicExtrasPred_MondayMonthInd*, as shown in the list *Extra Variable*. The numbers *1*, *2*, *3*, *4* and *5* represent the index of the Mondays in a month. **This plot shows a pick on the index 3, that is on the third Monday of the month**.

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